



List of titles in Series 737

- |                    |                           |
|--------------------|---------------------------|
| 1 water            | 18 big animals            |
| 2 ducks and swans  | 19 under the ground       |
| 3 man in the air   | 20 apes and monkeys       |
| 4 man and his car  | 21 living things          |
| 5 lions and tigers | 22 the tree and its world |
| 6 man on the sea   | 23 air                    |
| 7 dinosaurs        | 24 seals and whales       |
| 8 castles          | 25 reptiles               |
| 9 baby animals     | 26 deserts                |
| 10 roads           | 27 the stream             |
| 11 song birds      | 28 coffee                 |
| 12 trains          | 29 fire                   |
| 13 bridges         | 30 chocolate and cocoa    |
| 14 homes           | 31 bread                  |
| 15 leaves          | 32 polar regions          |
| 16 soldiers        | 33 mountains              |
| 17 sounds          | 34 forests                |

Ladybird titles cover a wide range of subjects and reading ages.  
Write for a free illustrated list from the publishers:

LADYBIRD BOOKS LTD Loughborough Leicestershire England

0 7214 0399 9 Printed in England

bridges

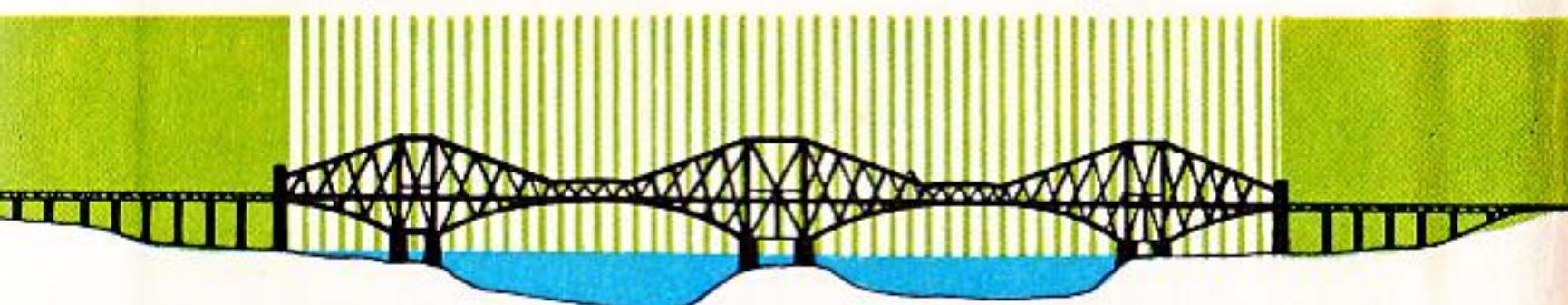
LADYBIRD LEADERS



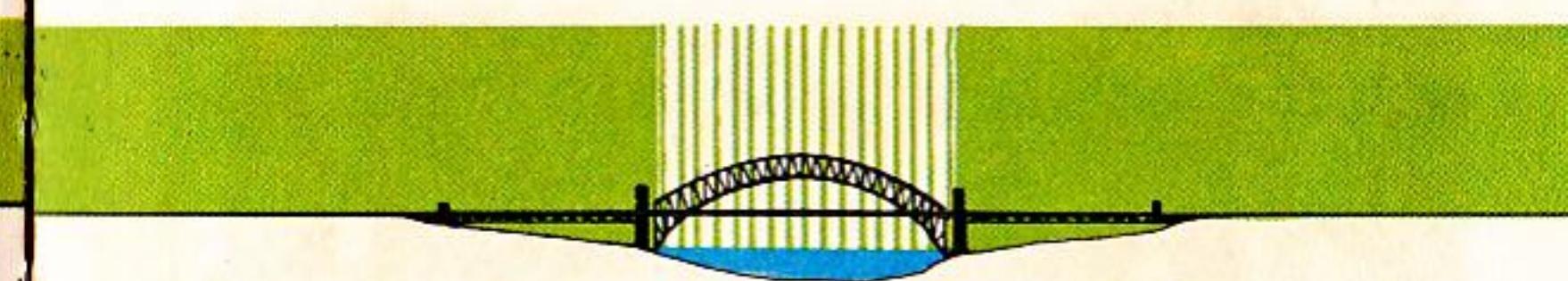
# bridges



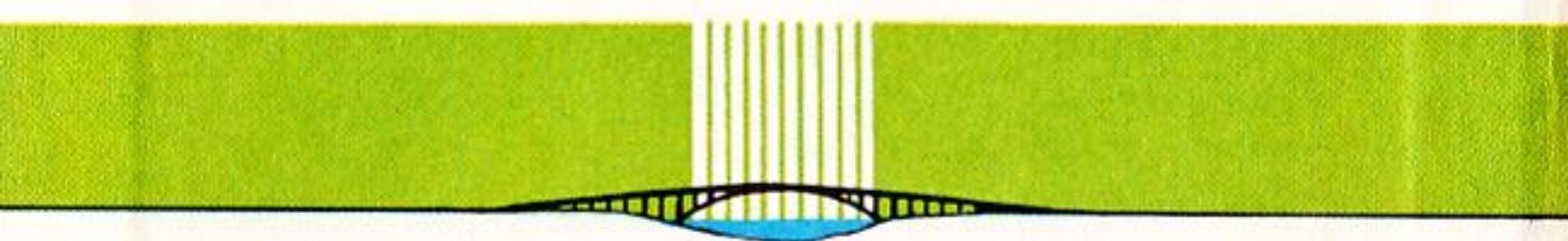
## Lengths of famous bridges



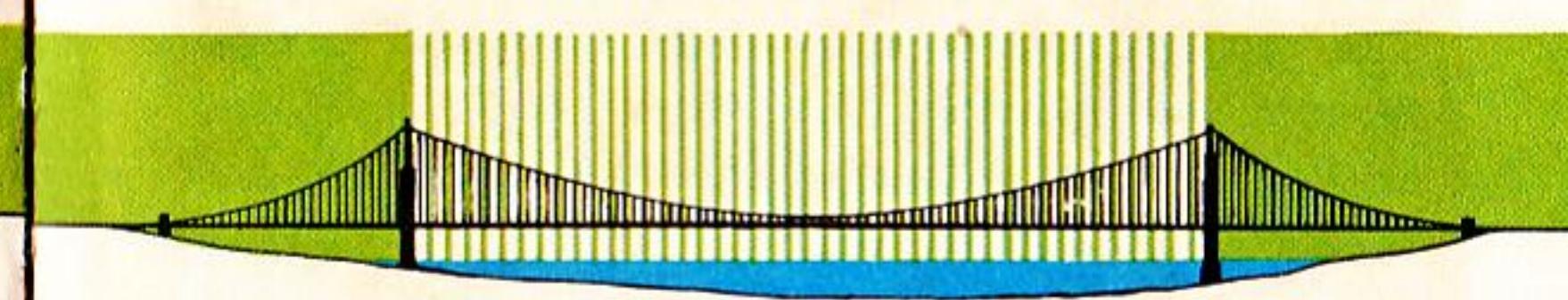
The Forth Railway Bridge  
1630 metres span *Pages 28-29*



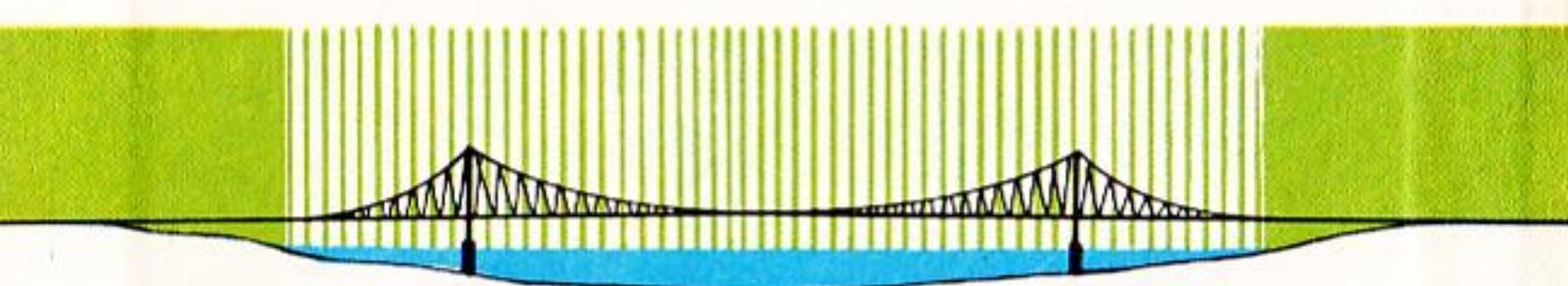
Sydney Harbour Bridge  
503 metres span *Pages 20-21*



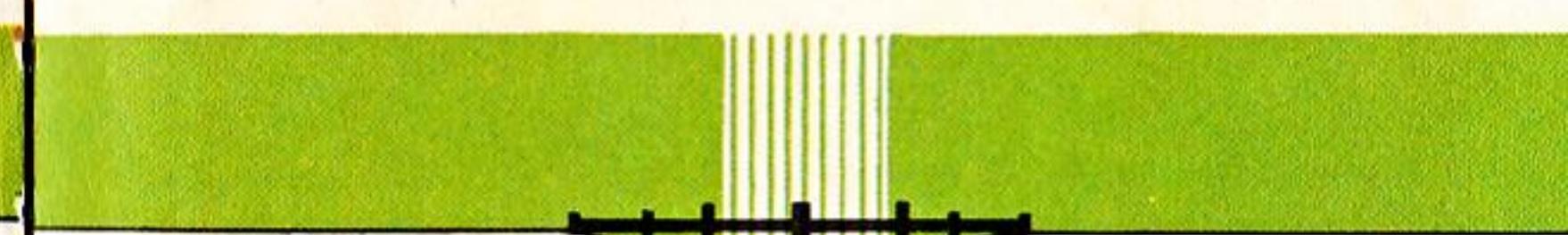
Gladesville Bridge  
305 metres span *Page 22*



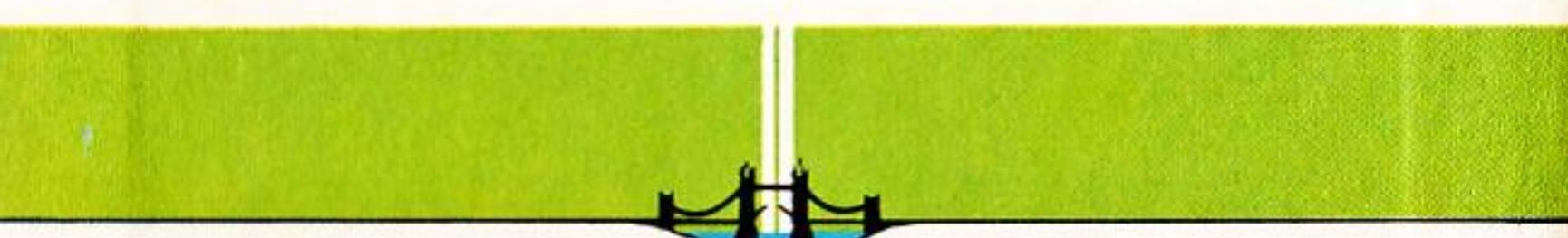
The Golden Gate Bridge  
1280 metres span *Page 26*



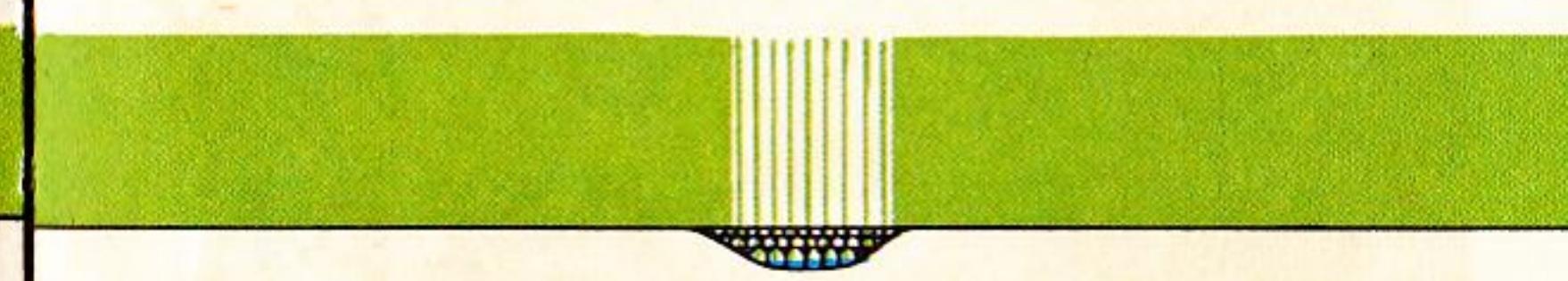
The Severn Bridge  
1615 metres span *Page 27*



Britannia Bridge  
274 metres span *Pages 18-19*



London Tower Bridge  
61 metres span *Page 34*



The Pont-du-Gard  
270 metres span *Page 10*

## **to teachers and parents**

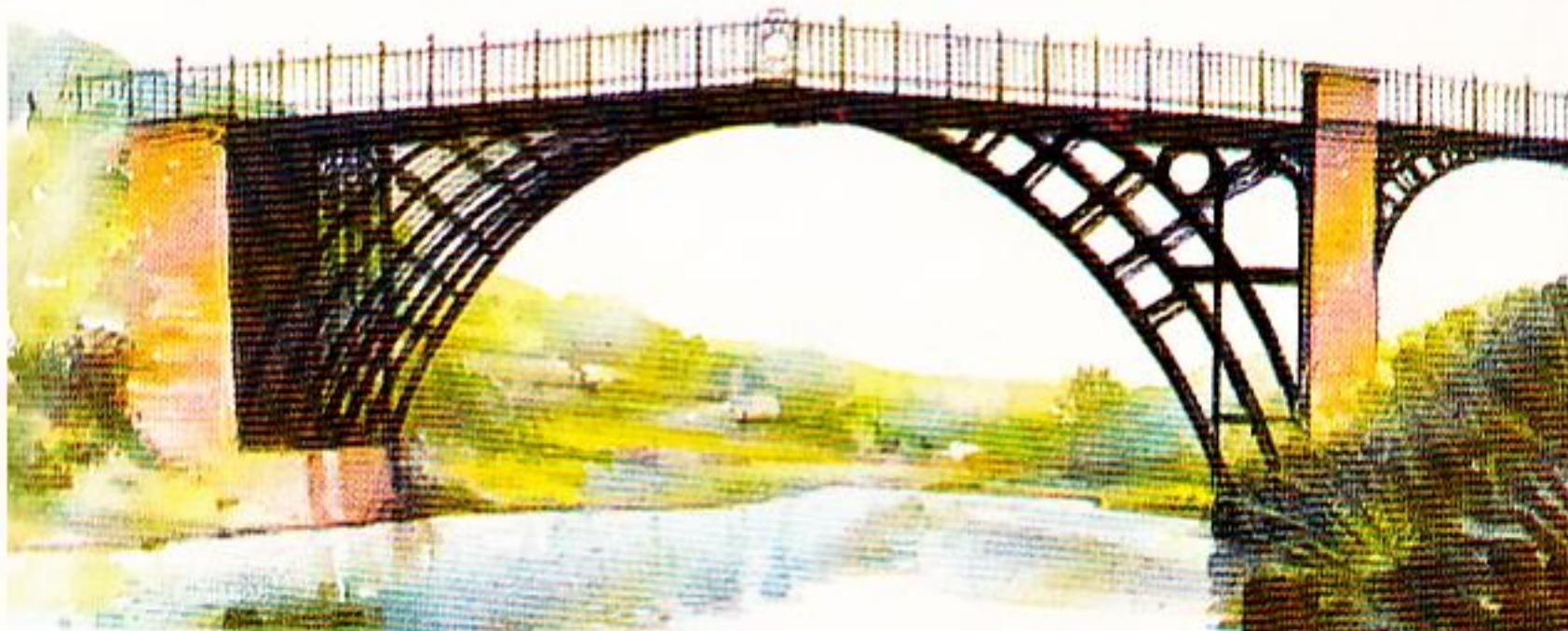
This is a LADYBIRD LEADER book, one of a series specially produced to meet the very real need for carefully planned *first information books* that instantly attract enquiring minds and stimulate reluctant readers.

The subject matter and vocabulary have been selected with expert assistance, and the brief and simple text is printed in large, clear type.

Children's questions are anticipated and facts presented in a logical sequence. Where possible, the books show what happened in the past and what is relevant today.

Special artwork has been commissioned to set a standard rarely seen in books for this reading age and at this price.

Full colour illustrations are on all 48 pages to give maximum impact and provide the extra enrichment that is the aim of all Ladybird Leaders.



# **A Ladybird Leader bridges**

written by Robert Loxley

illustrated by Gerald Witcomb and Gavin Rowe

---

© LADYBIRD BOOKS LTD 1974, 1976

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photo-copying, recording or otherwise, without the prior consent of the copyright owner.

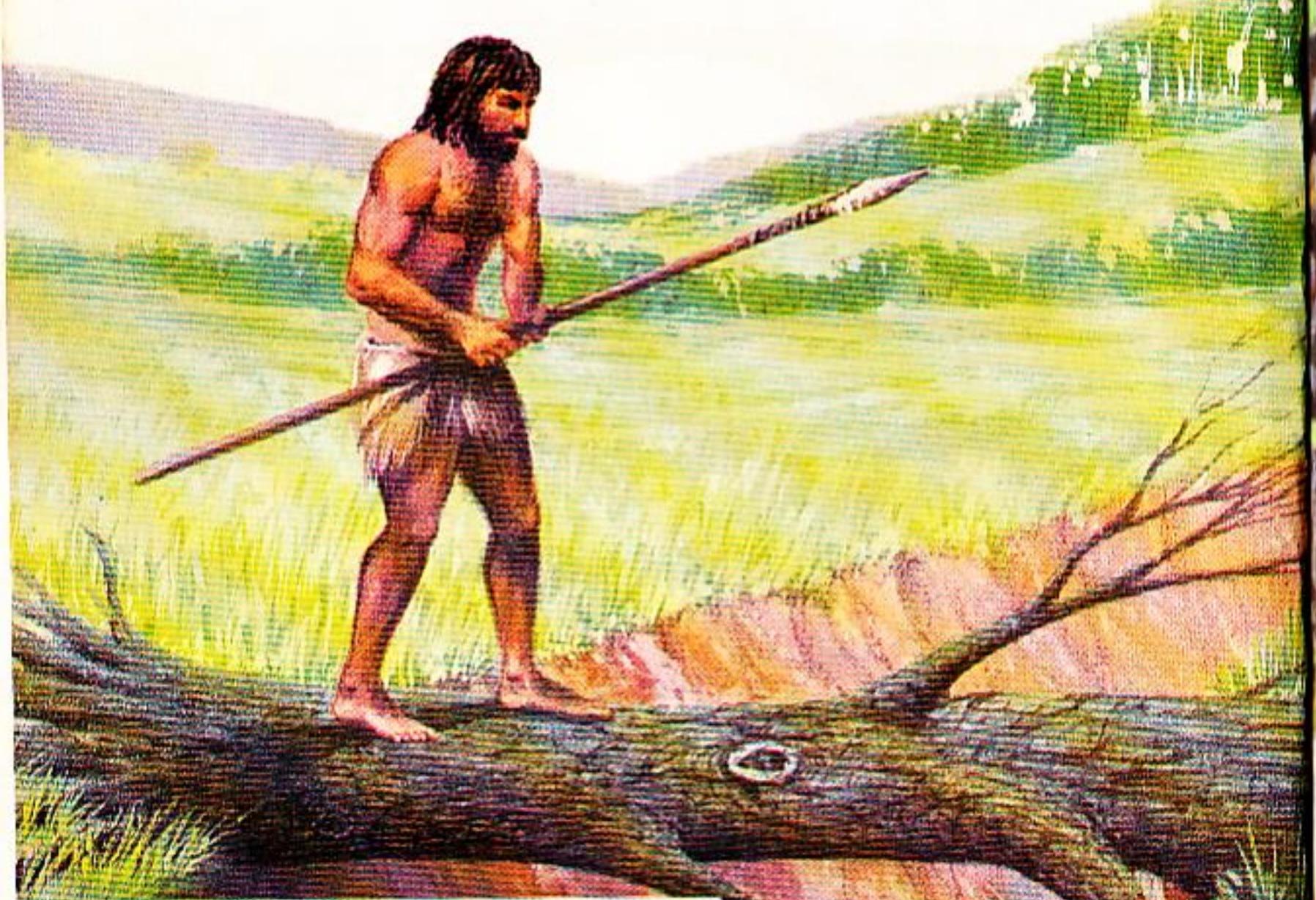
Ladybird Books Ltd Loughborough 1976

## Nature made the first bridges

The very first bridges  
were not made by men.

Fallen trees were used to cross rivers.

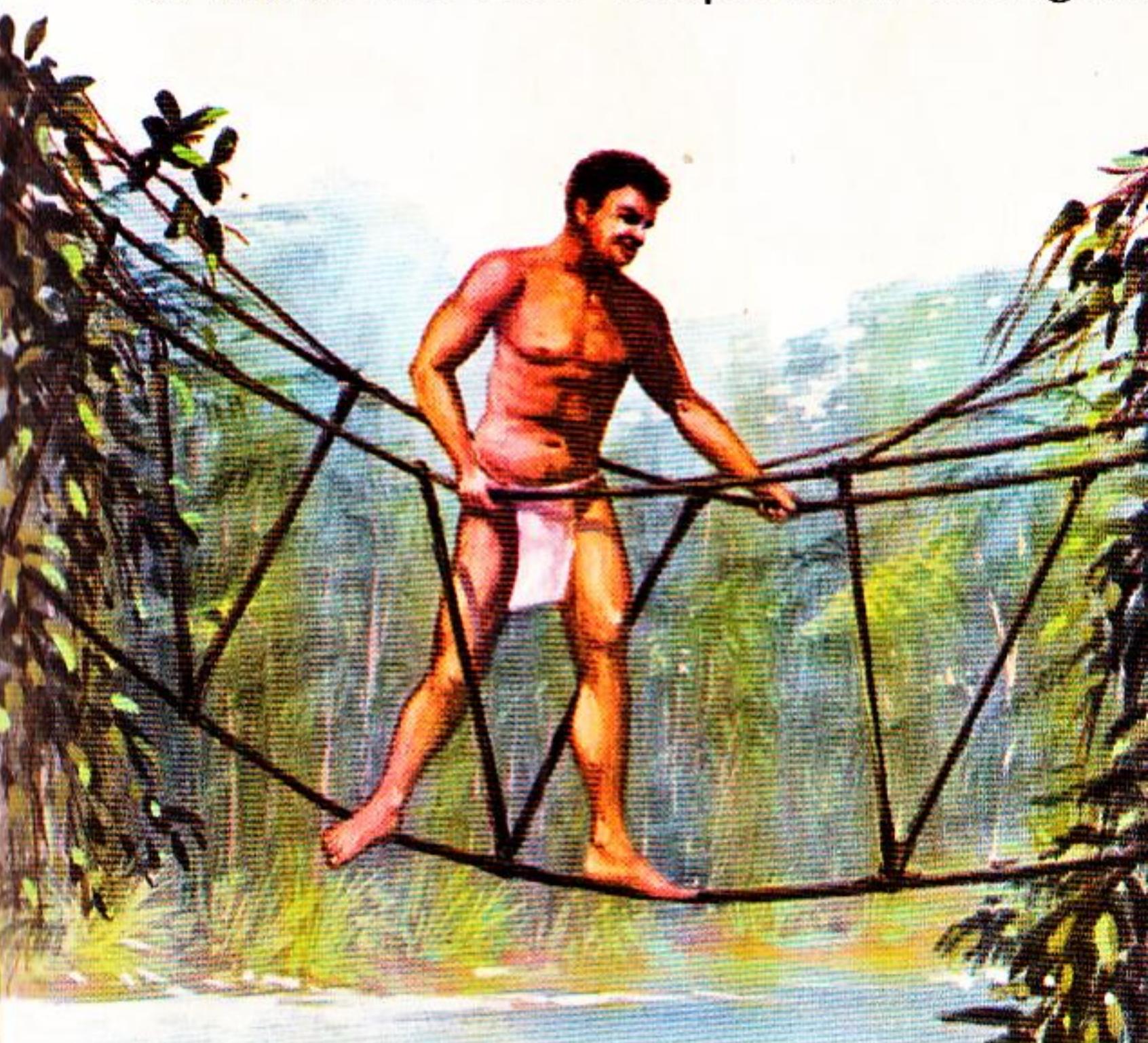
Trees used like this  
were simple 'beam' bridges.



A beam bridge over a road

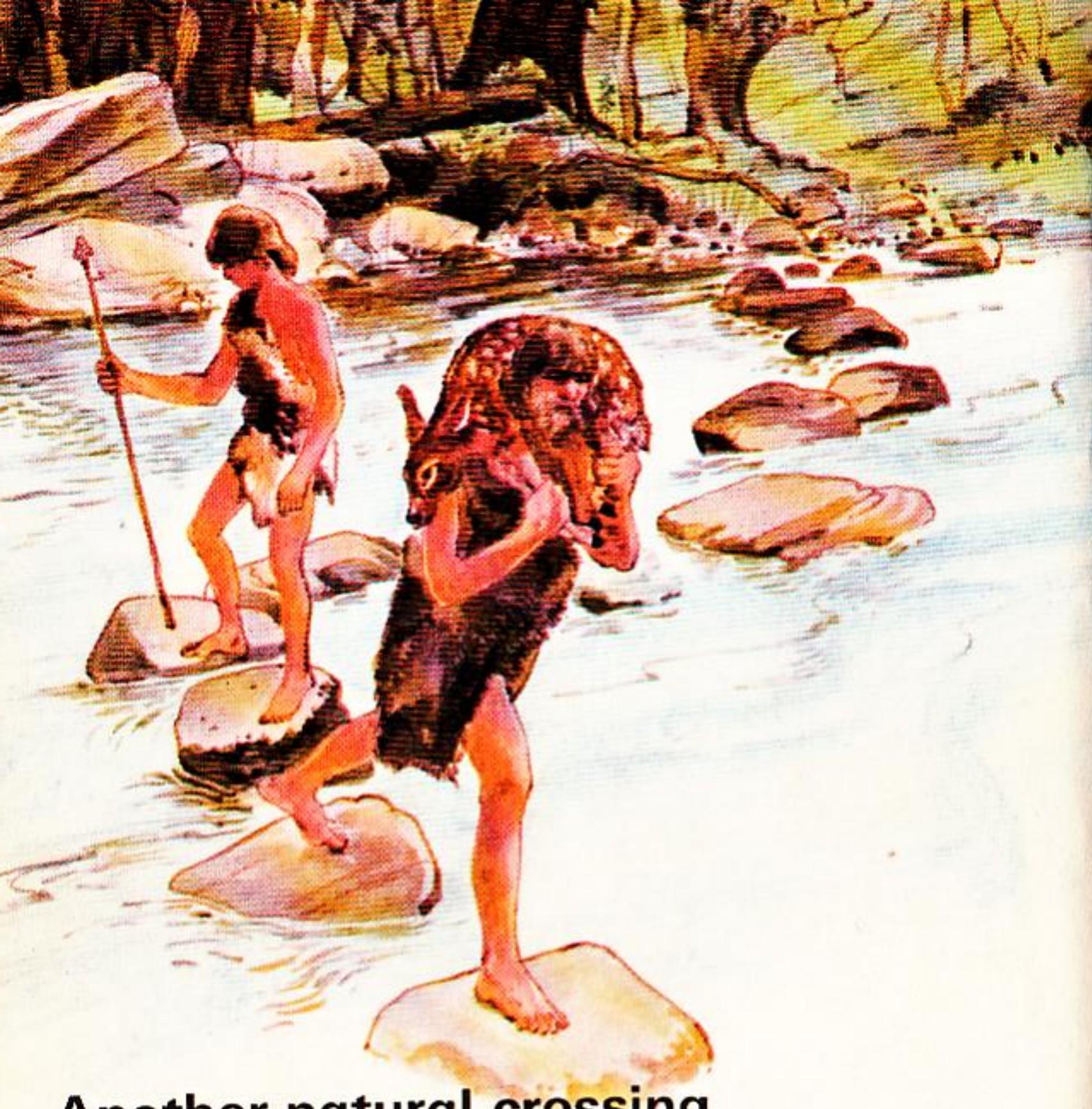


In hot countries,  
ropes were made from vine stems.  
The ends were tied to trees  
to make the first 'suspension' bridges.



A suspension  
bridge



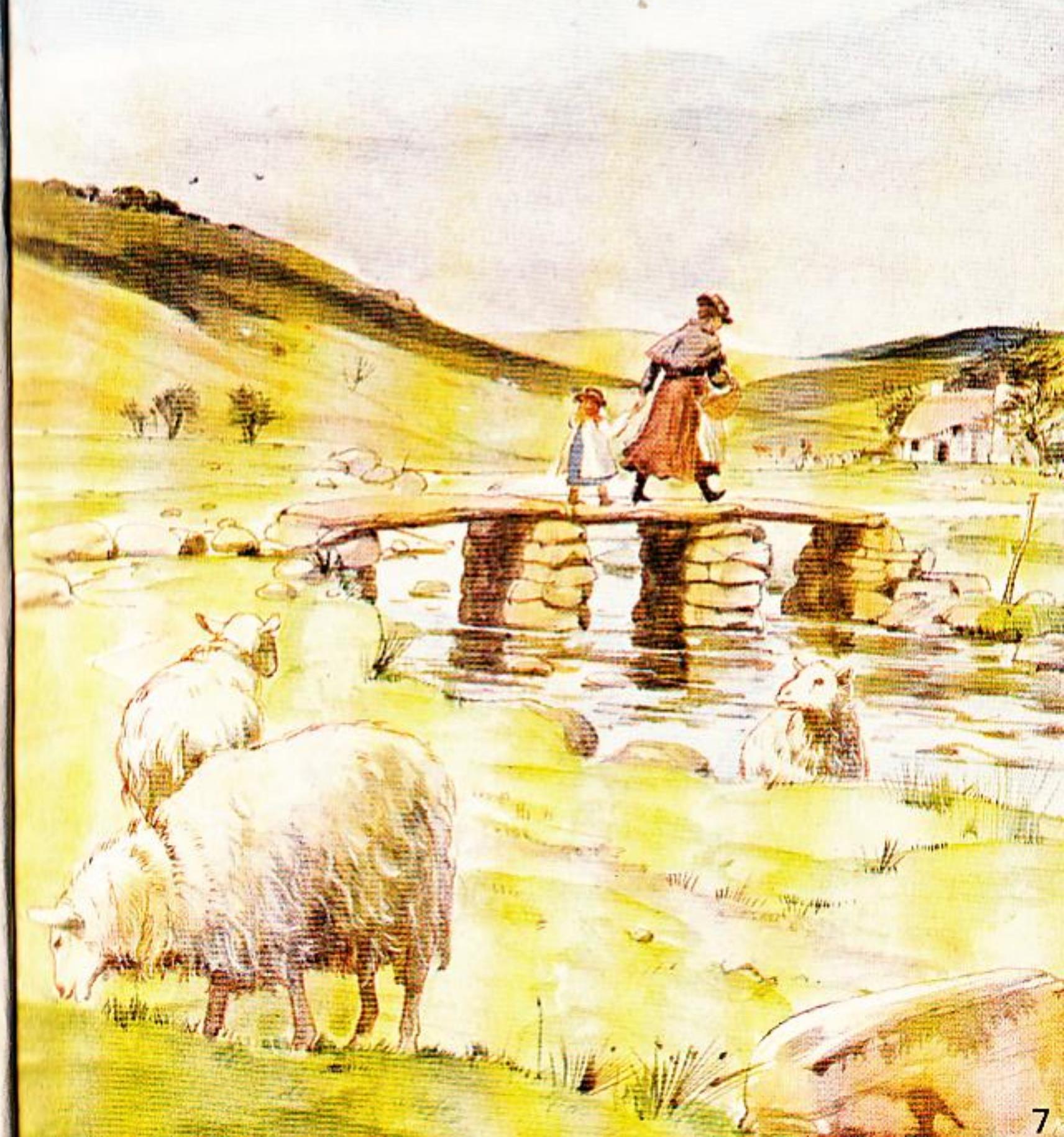


### Another natural crossing

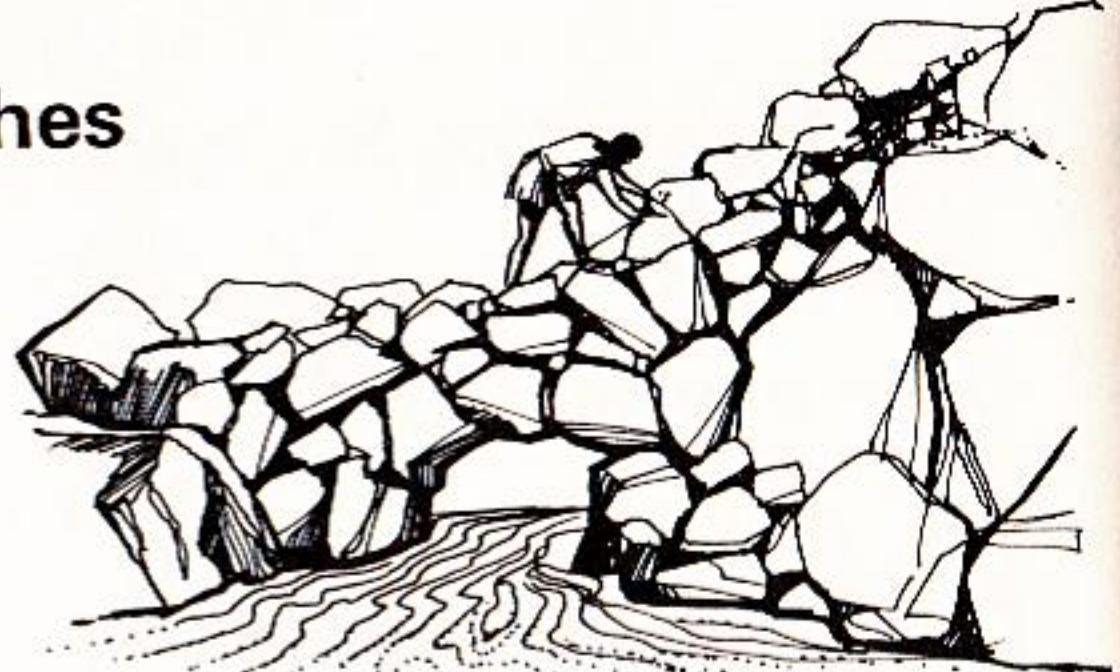
Some shallow rivers have rocks in them.  
People crossed  
by stepping from stone to stone.  
In some rivers, broad flat stones  
were put down as 'stepping stones'.

### A simple stone bridge

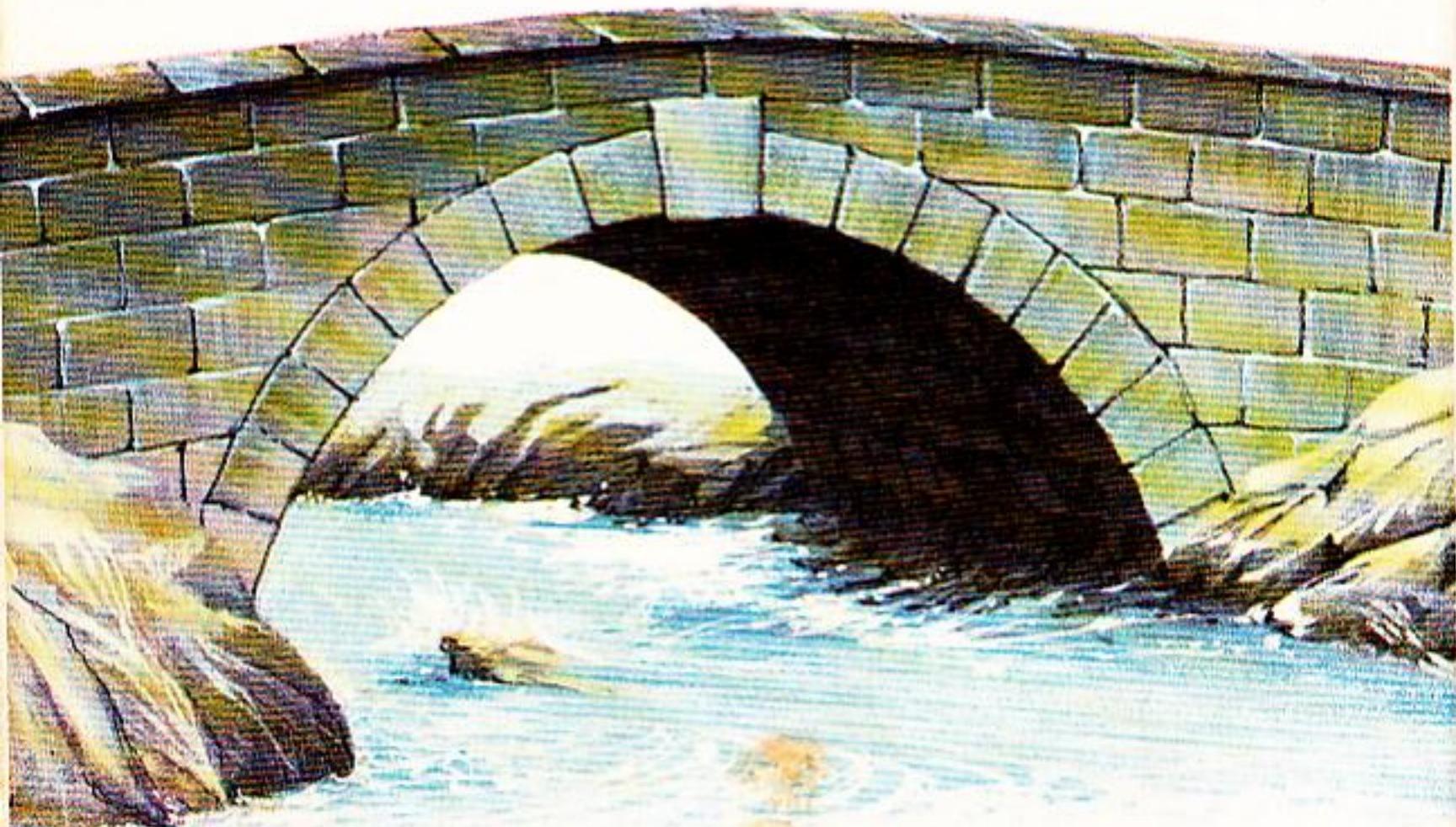
Later, piles of stones  
were placed in a river.  
Flat stone slabs were put across them.  
These made a 'clapper' bridge.



## The first arches



Falls of rock sometimes make a natural arched bridge.



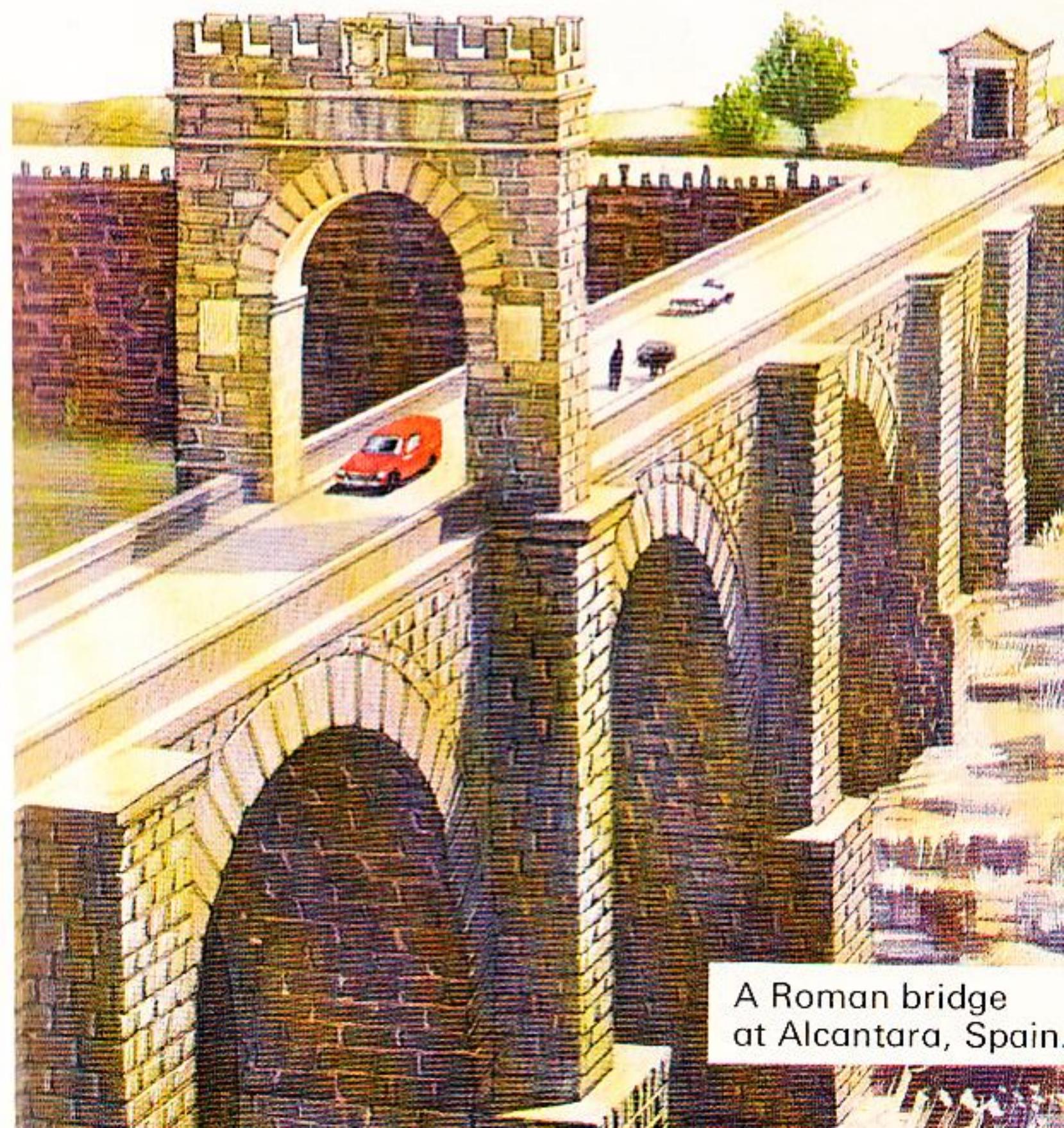
Stone slabs can break if they are too long.

Men learned how to make an arch with smaller stones.

A stone bridge is stronger with an arch.

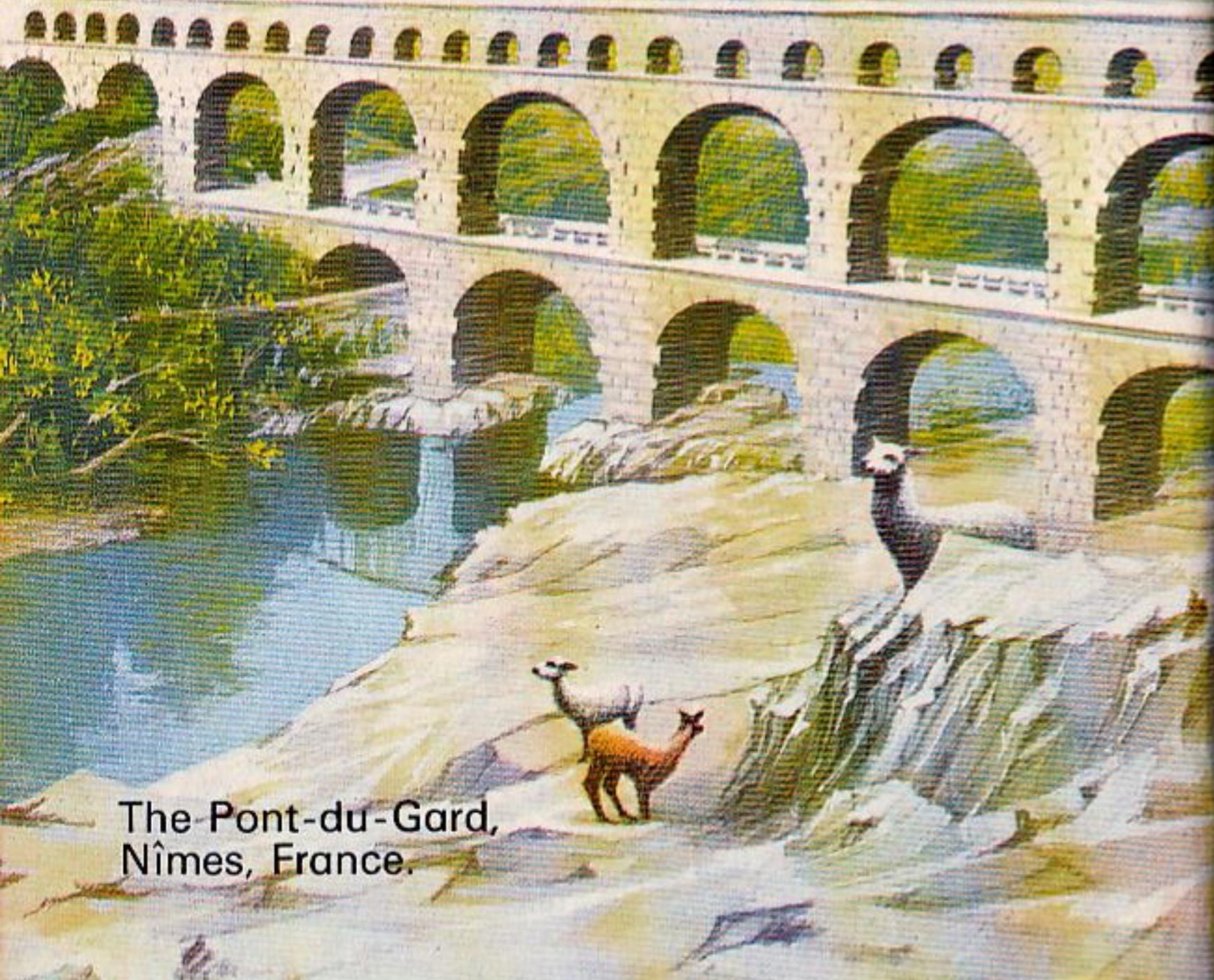
## A Roman bridge that is still used

The Romans were great bridge builders. The Roman who built this one said, 'I will build a bridge that will last for ever !'



A Roman bridge at Alcantara, Spain.

## A tall Roman bridge with many arches



The Pont-du-Gard,  
Nîmes, France.

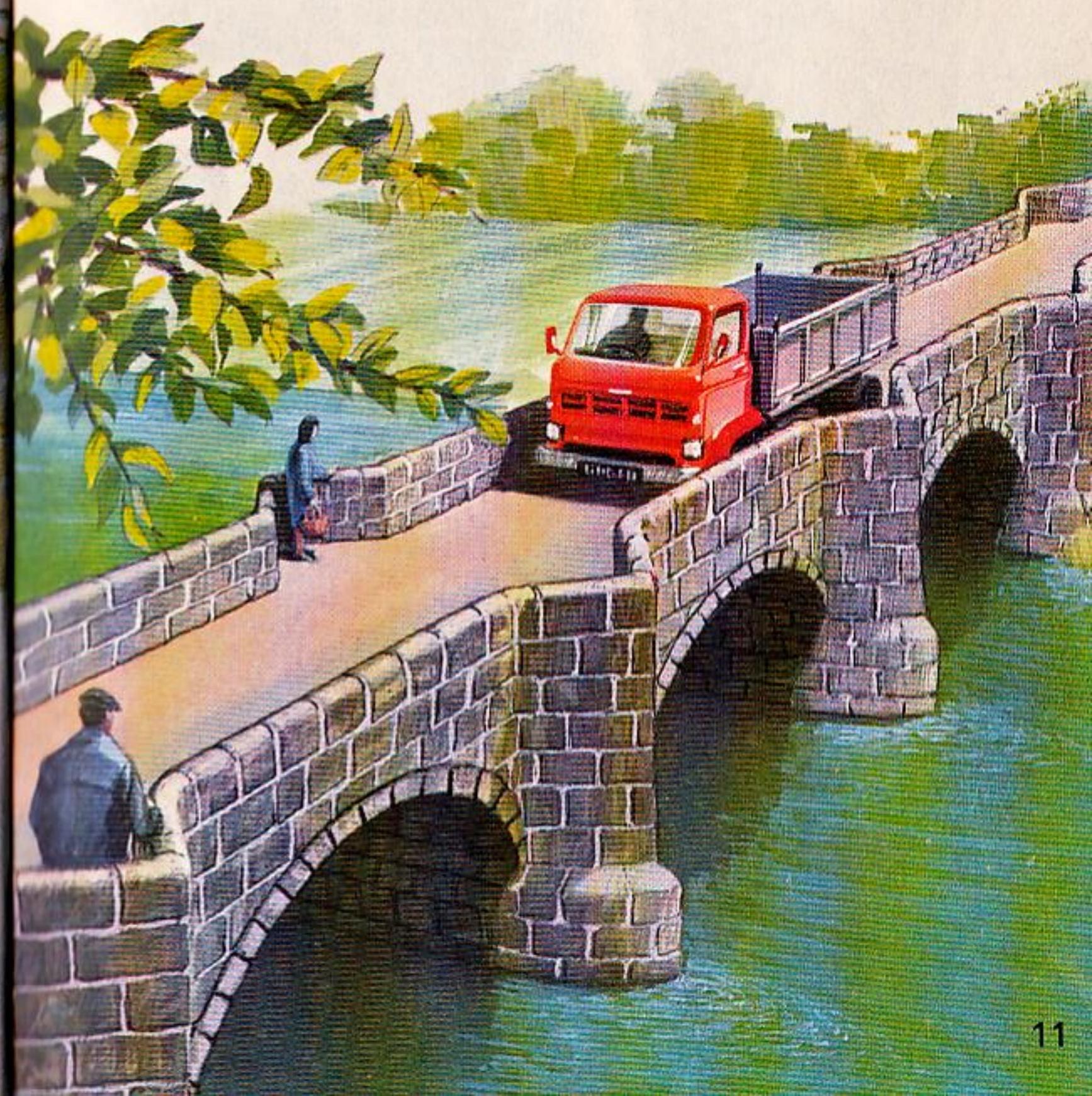
If a valley was very deep,  
the Romans built arches  
on top of other arches.

The Roman word for water was  
'aqua' (ak-wa).

This bridge carried water to a town,  
so it is called an aqueduct.

## A stone bridge of the Middle Ages

The pointed 'cutwaters' of this bridge stop the stonework being worn away.  
Long ago, people stood in the 'refuges' out of the way of horses and carts.  
These refuges are still useful today.





### A packhorse bridge of the 17th century

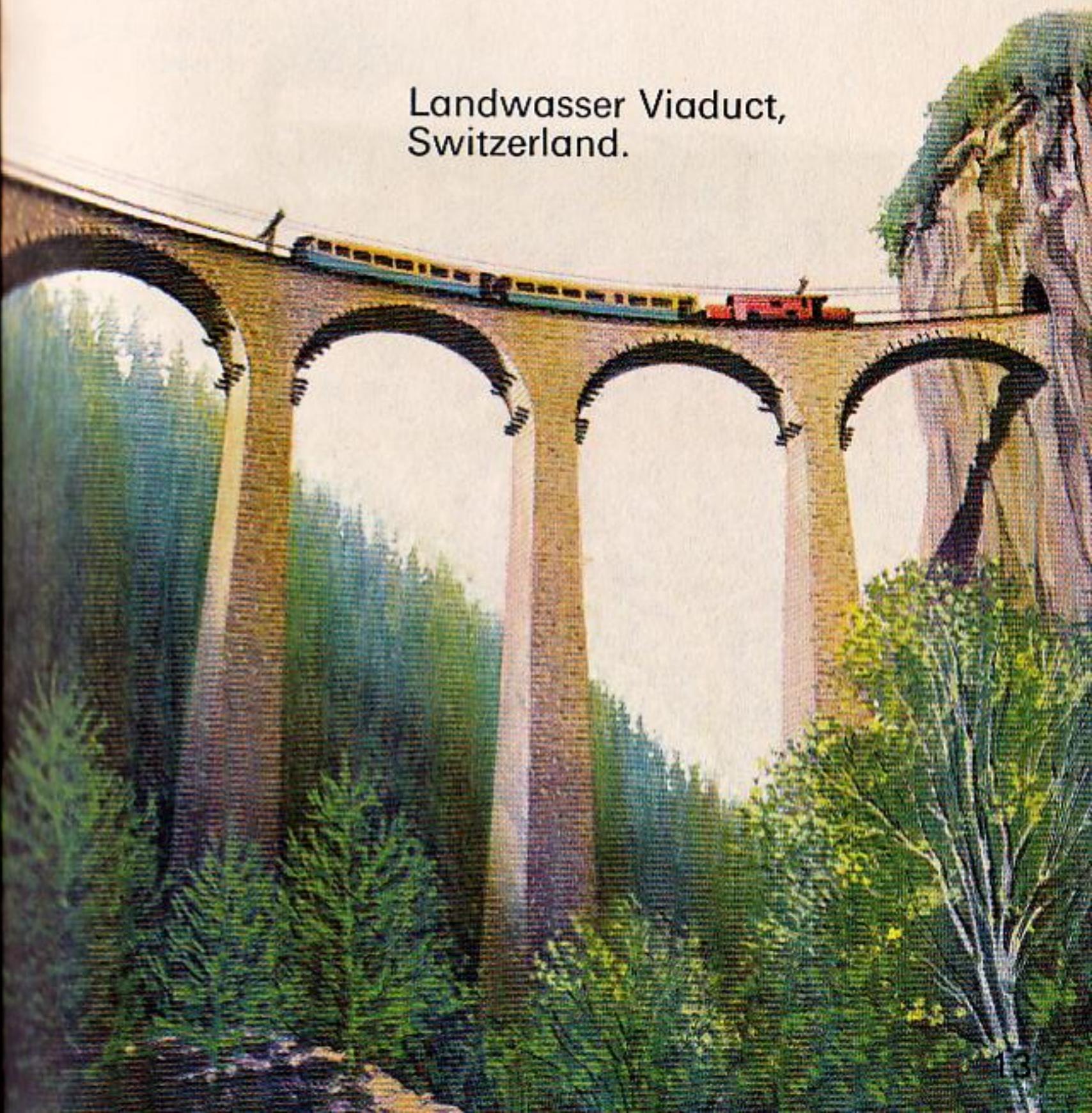
When there were few roads,  
goods were often carried in packs  
on the backs of horses or mules.

The bridges built for them  
were called packhorse bridges.

### A very tall stone bridge

Bridges with arches can be very tall.  
This one is in Switzerland.  
It carries a railway  
over a very deep valley.

Landwasser Viaduct,  
Switzerland.



## A bridge made of wood

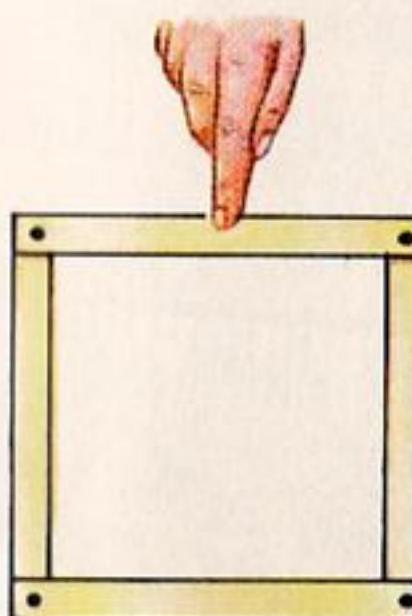
This wooden bridge is in Africa.

It is called a 'trestle' bridge.

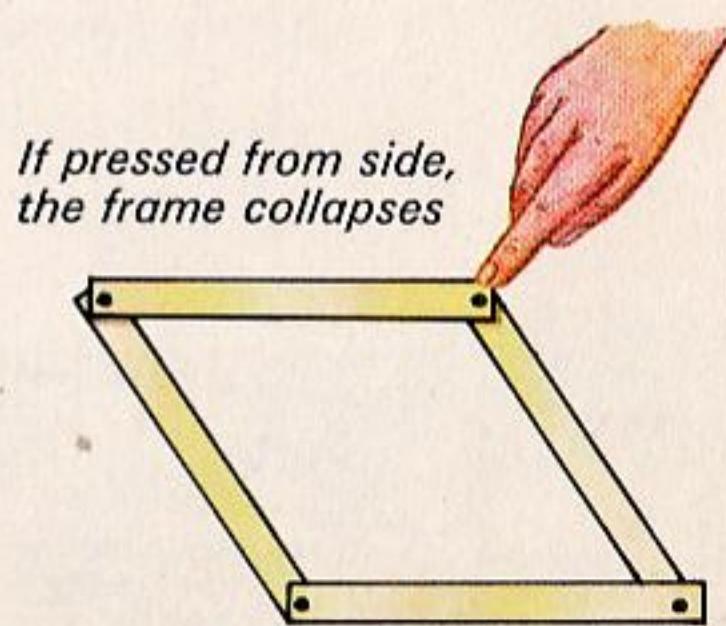
Many bridges like this were built  
to carry the first railways in America.



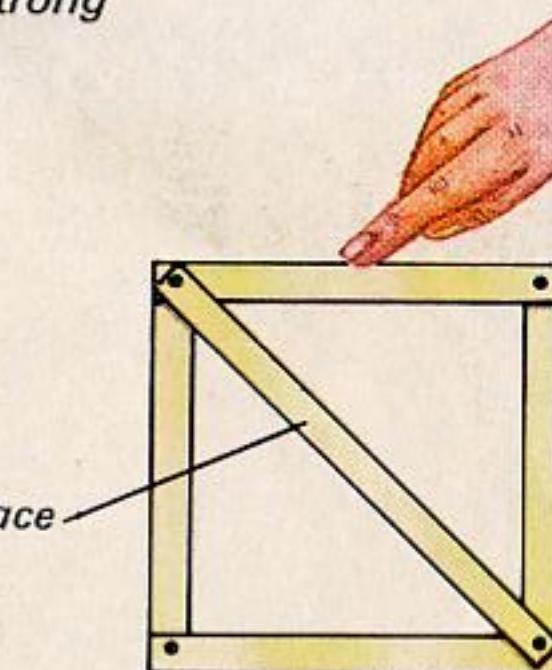
## How 'braces' make a bridge stronger



*If pressed straight down,  
this frame is quite strong*



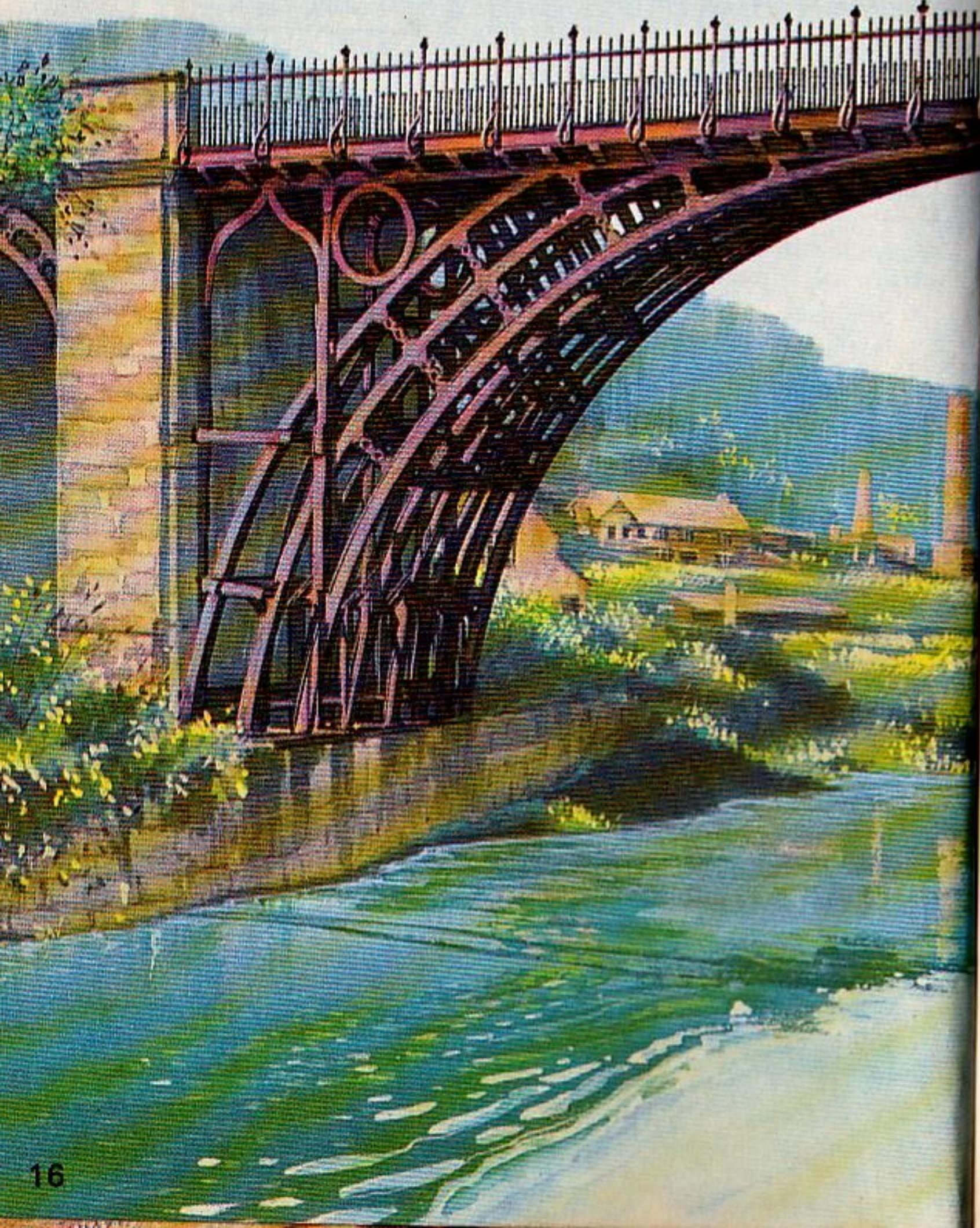
*If pressed from side,  
the frame collapses*



*brace*  
*The brace keeps  
the frame firm.*

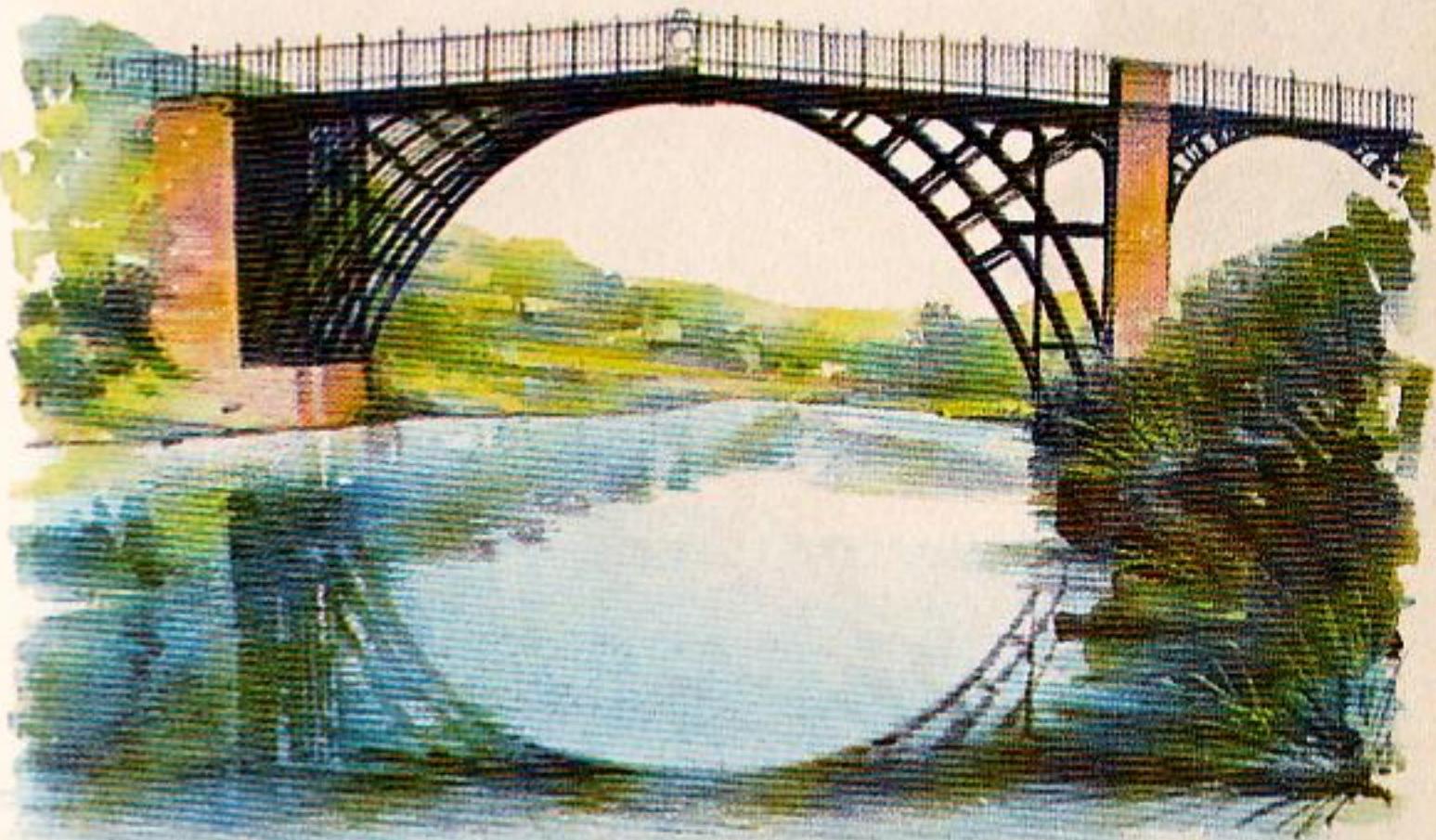


## The first iron bridge

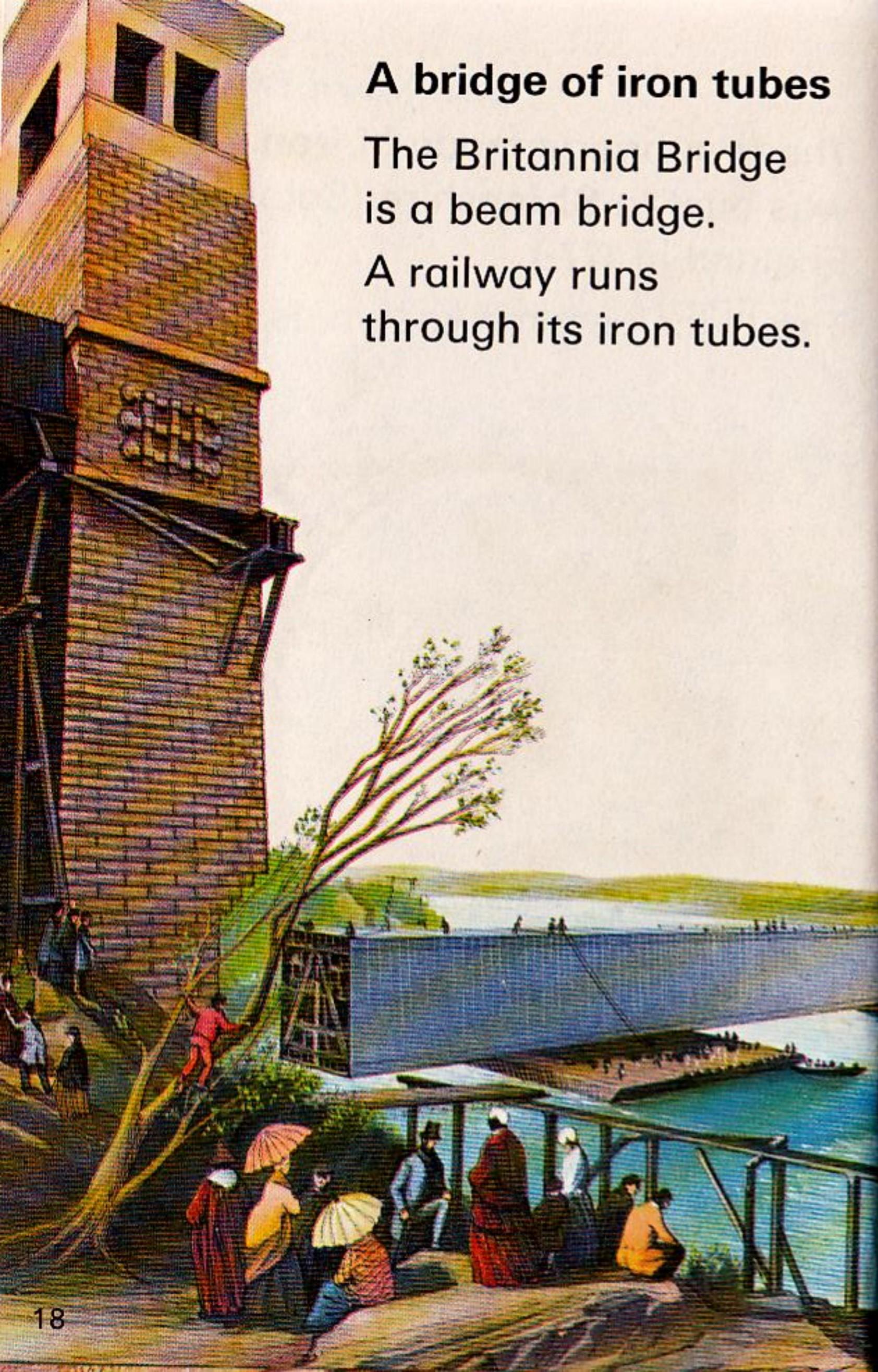


The first bridge made of iron was built in Shropshire (Salop), England in 1779.

The place became known as Ironbridge.



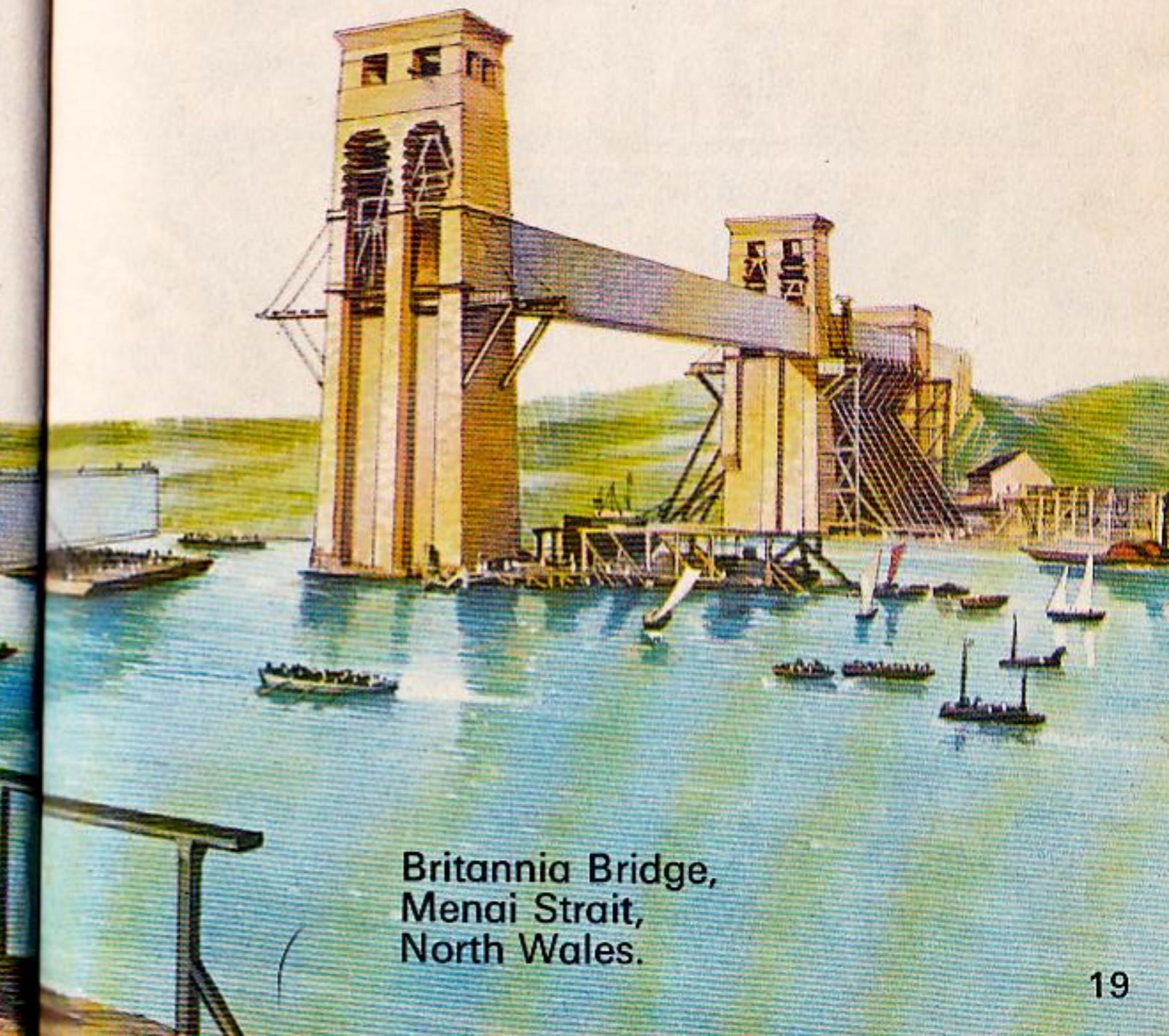
Before that time,  
bridges had been made  
of rope, stone, brick or wood.



## A bridge of iron tubes

The Britannia Bridge  
is a beam bridge.  
A railway runs  
through its iron tubes.

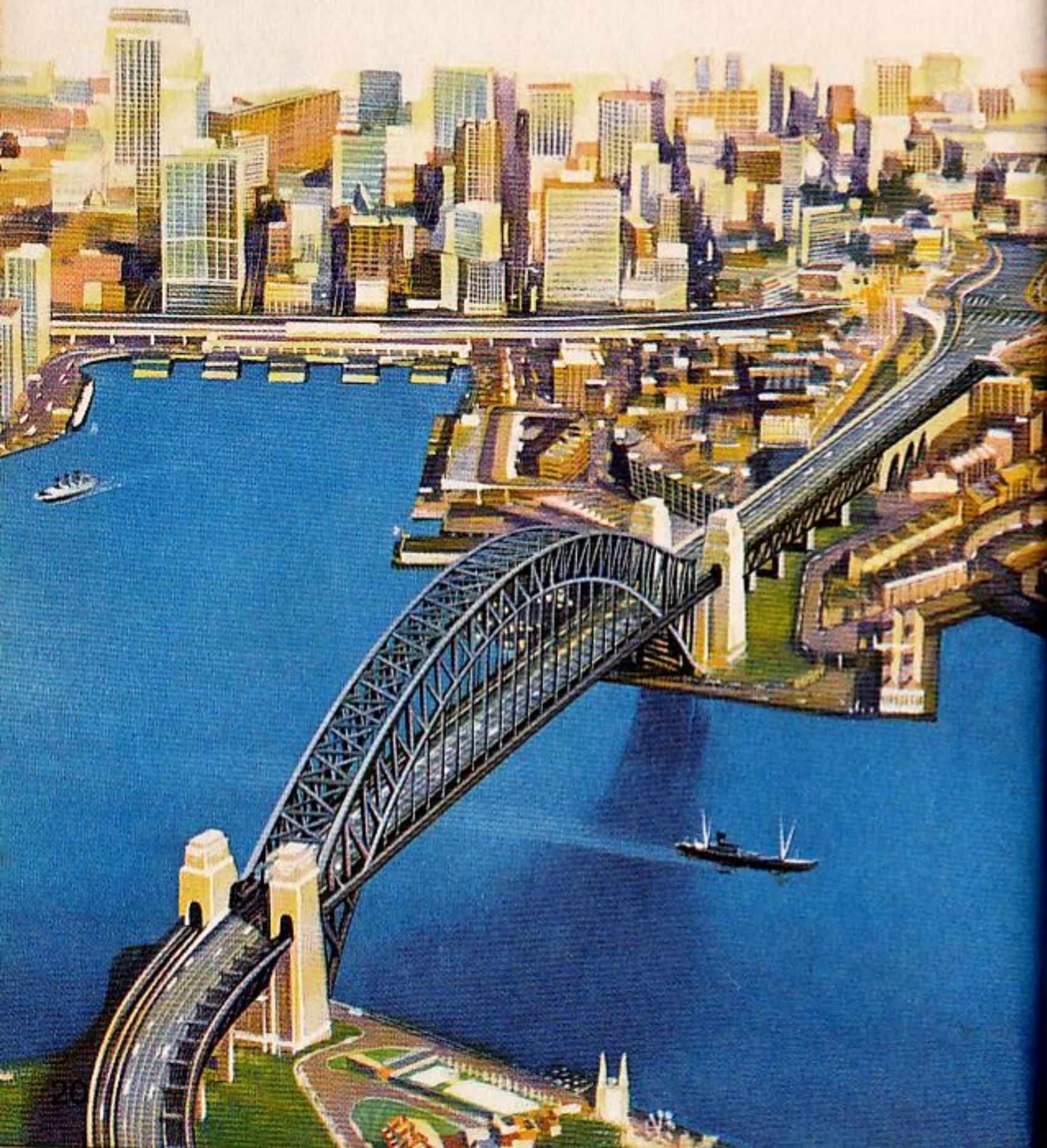
The tubes were floated from the shore.  
Then they were lifted into place  
over 30 metres  
above the water.



Britannia Bridge,  
Menai Strait,  
North Wales.

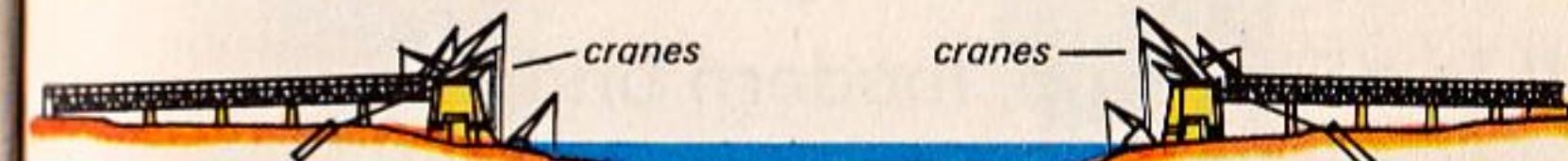
## A famous steel bridge in Australia

Sydney Harbour Bridge has the largest steel arch in the world. The bridge has eight traffic lanes, two railway lines, a footway and a bicycle track.

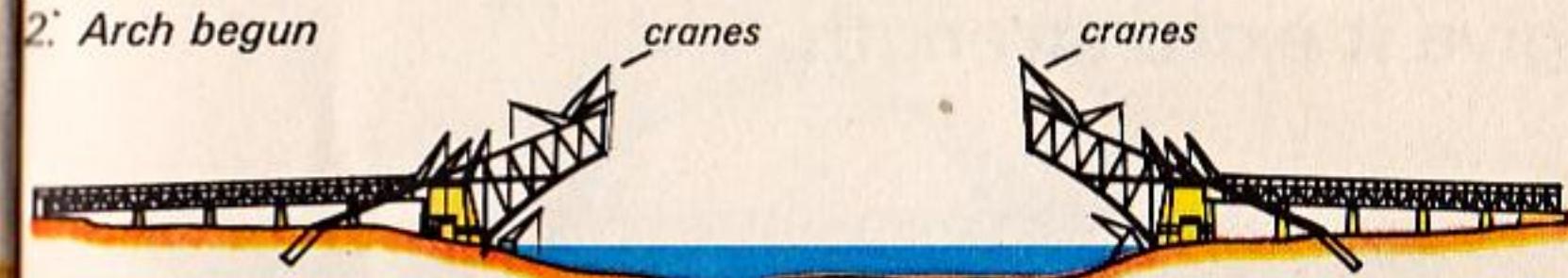


## How the bridge was built

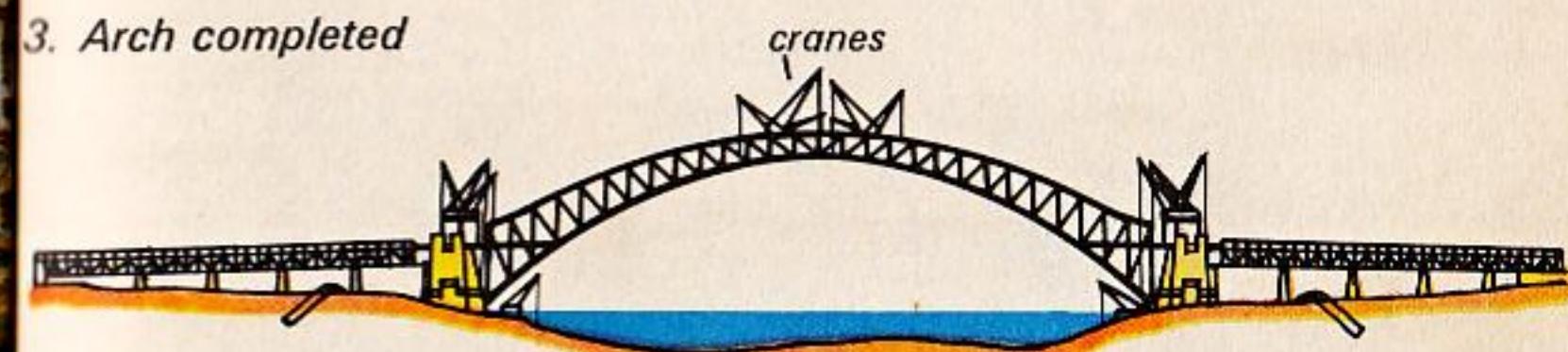
1. Approach roads prepared



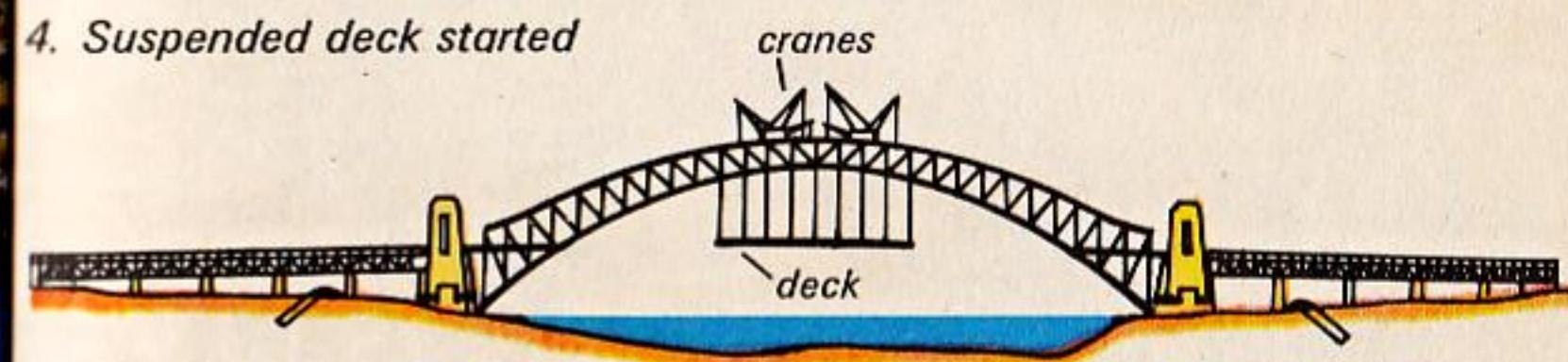
2. Arch begun



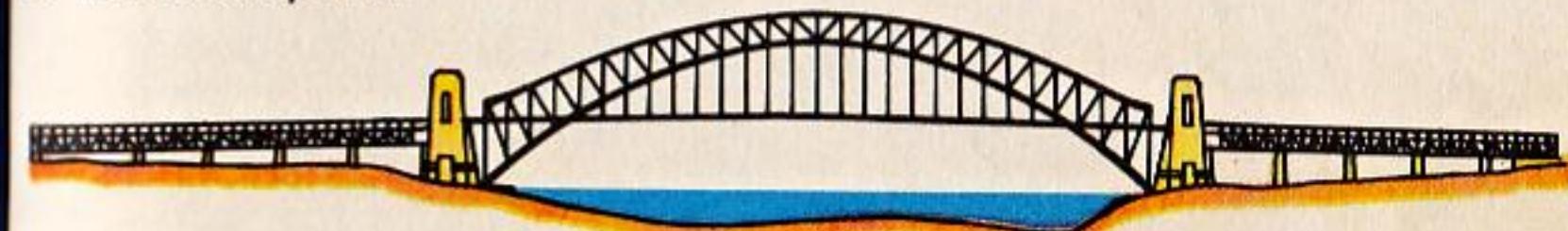
3. Arch completed



4. Suspended deck started



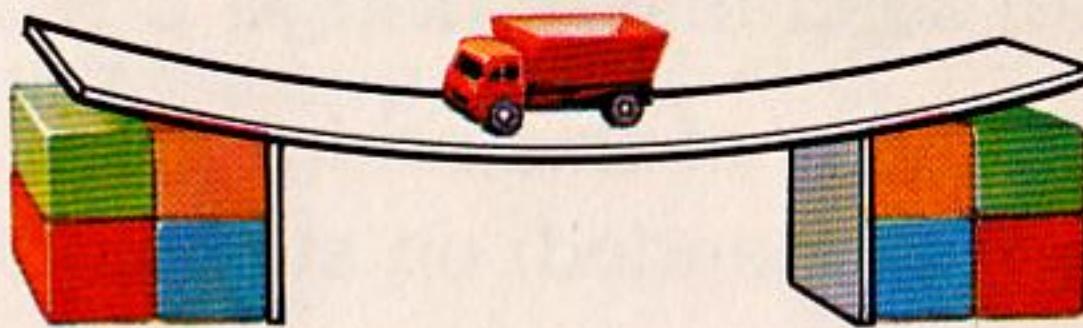
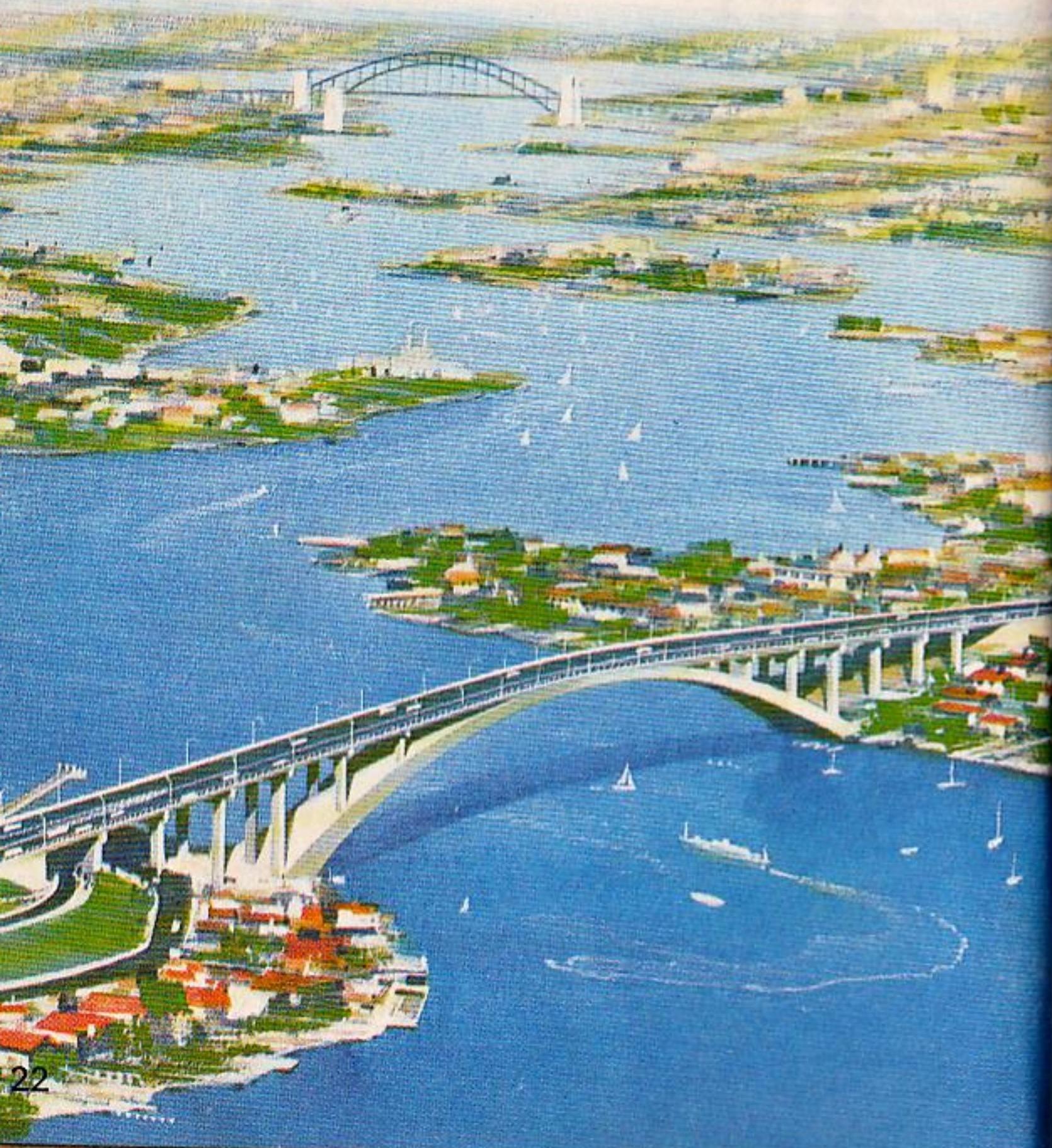
5. Deck completed



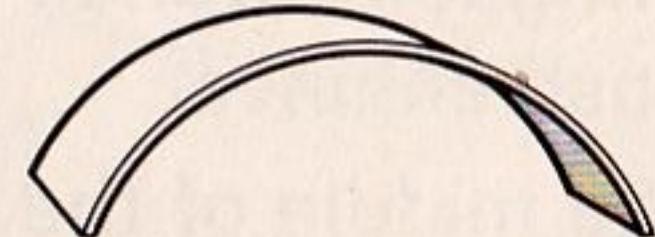
## A modern bridge with a concrete arch

The Gladesville Bridge is also at Sydney.  
It is a very fine, modern bridge.

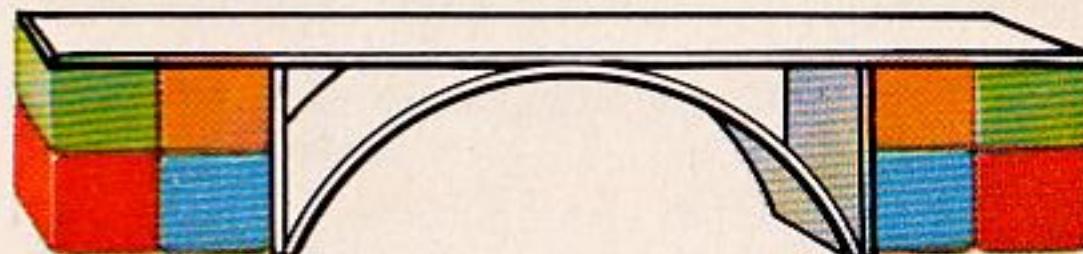
Steel rods in the concrete  
give it extra strength.



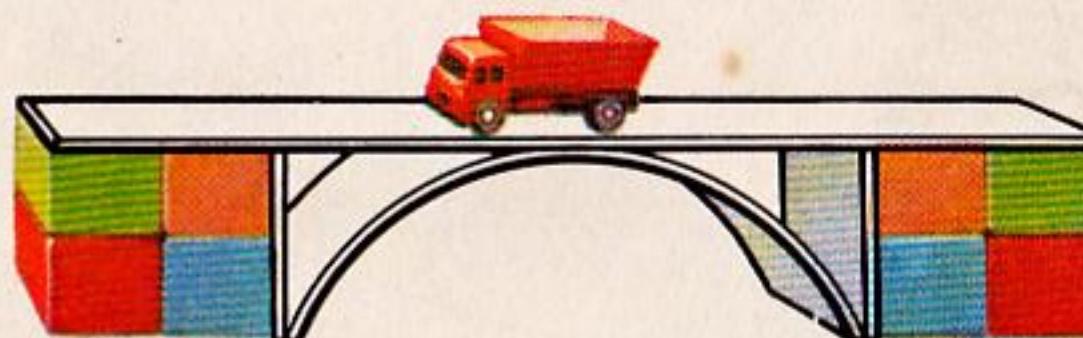
*This simple bridge is weak*



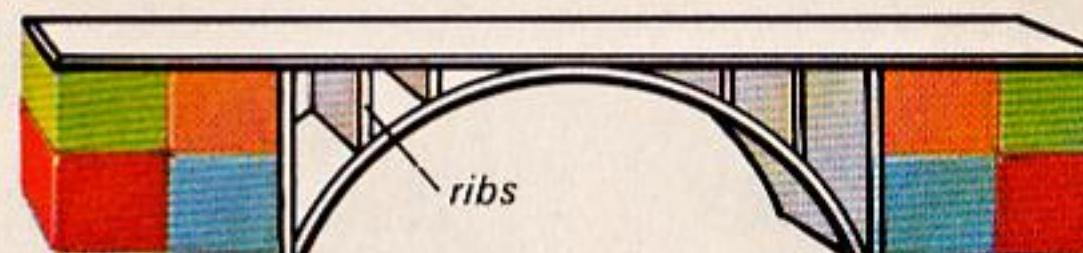
*An arch gives strength*



*Arch added to bridge*



*Bridge is now stronger*



*Ribs make bridge stronger still*

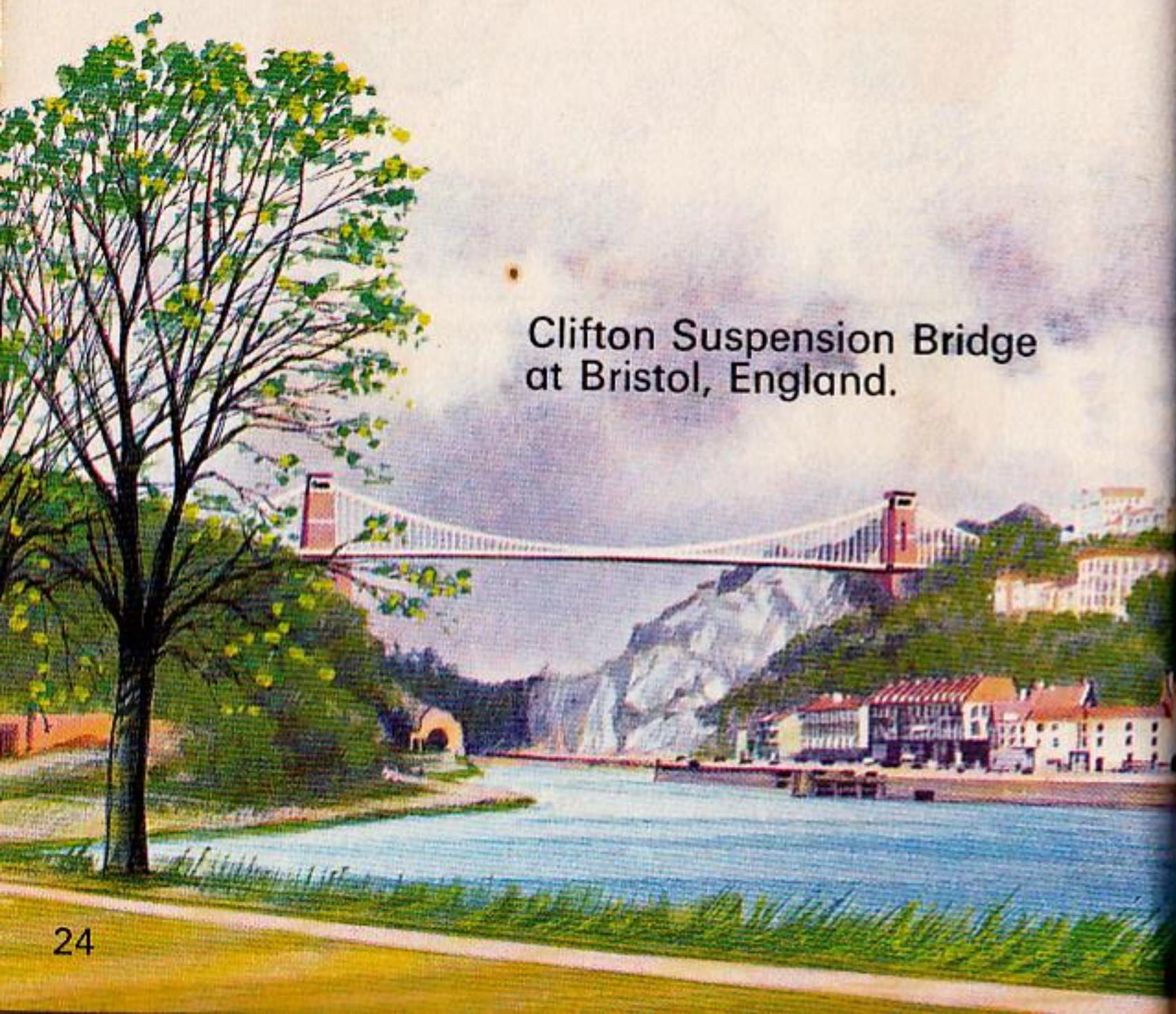
Try making a bridge like this with cardboard

## A steel suspension bridge

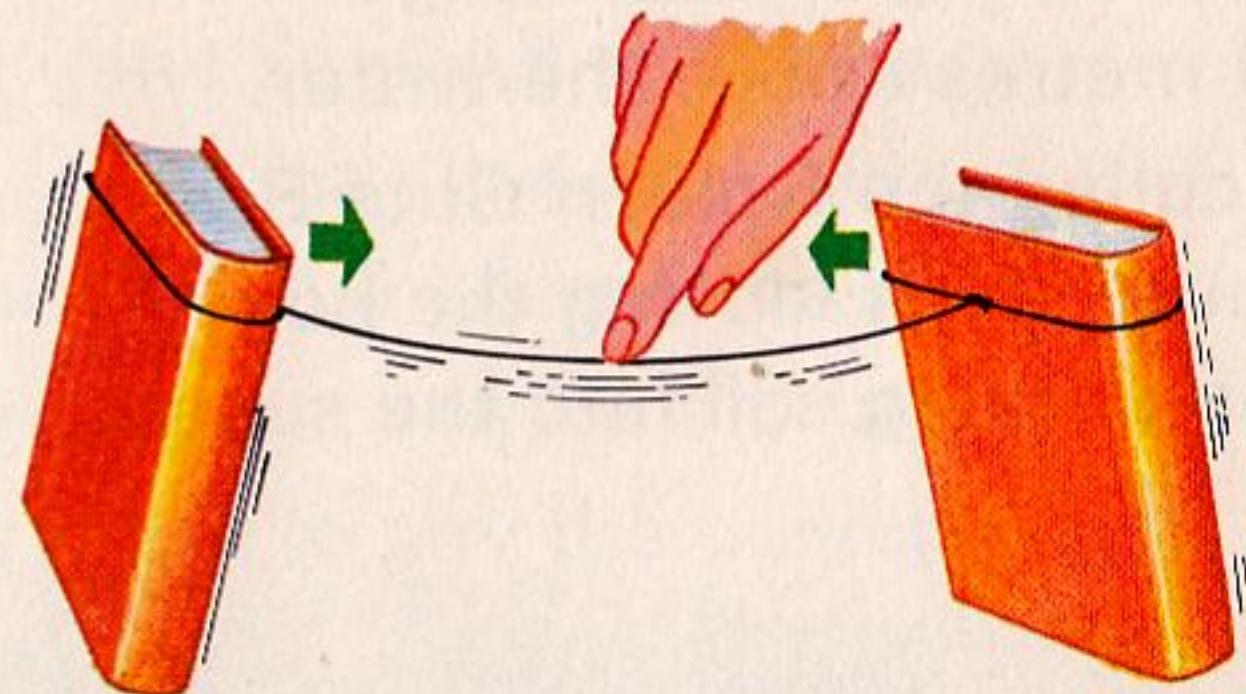
The roadway of this bridge is hung (suspended) on steel cables.

It was built by Isambard Kingdom Brunel, a great British engineer.

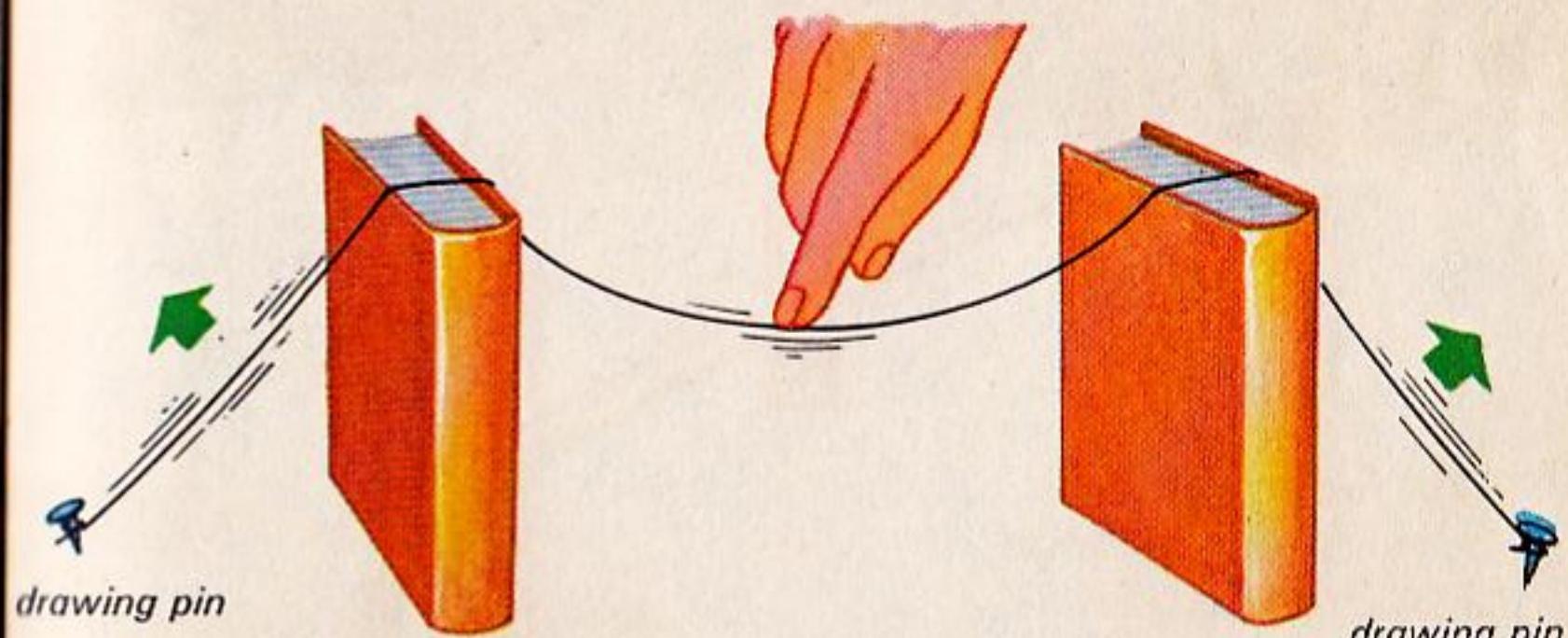
In a gale, the middle of the bridge can move 300 mm up and down.



## How a suspension bridge must be supported



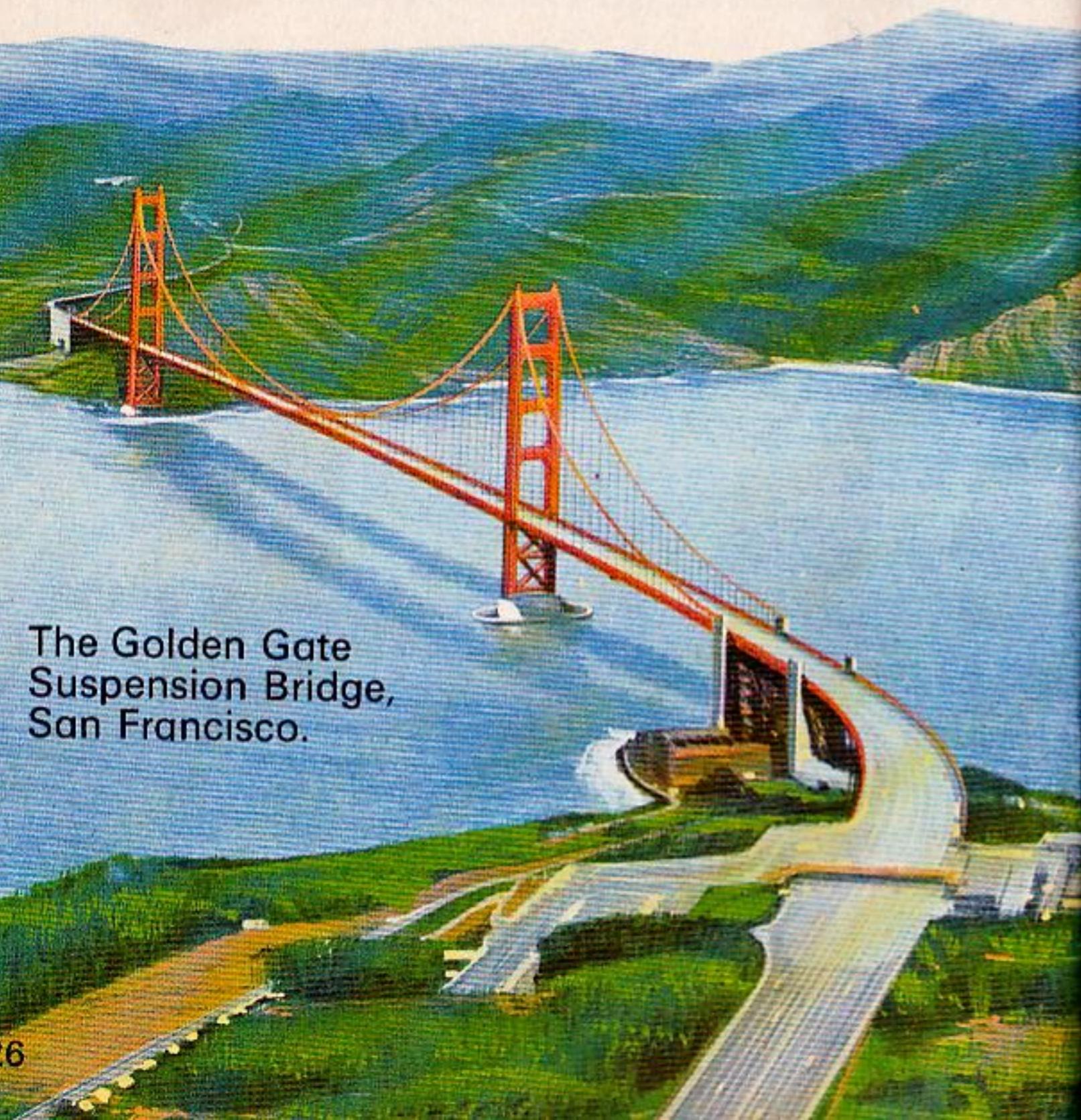
*When the middle of the string is pressed, the books fall inwards*



*With the ends of the string fastened like this, the books will not fall inwards*

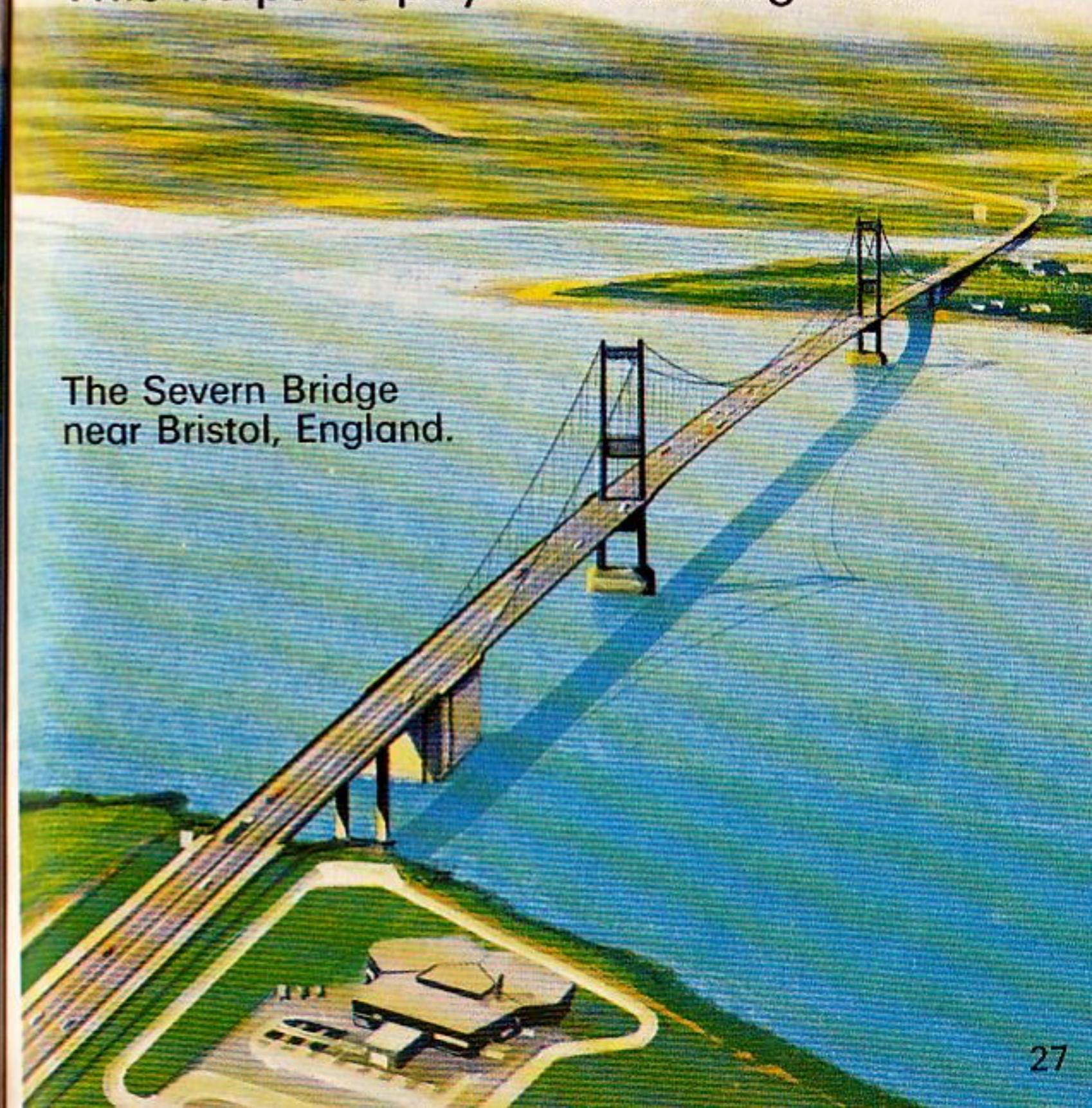
## Some modern steel suspension bridges

The roadway of this bridge is 81 metres above the water. It is called the Golden Gate Bridge because ships leaving the bay in the evening sail into the sunset.

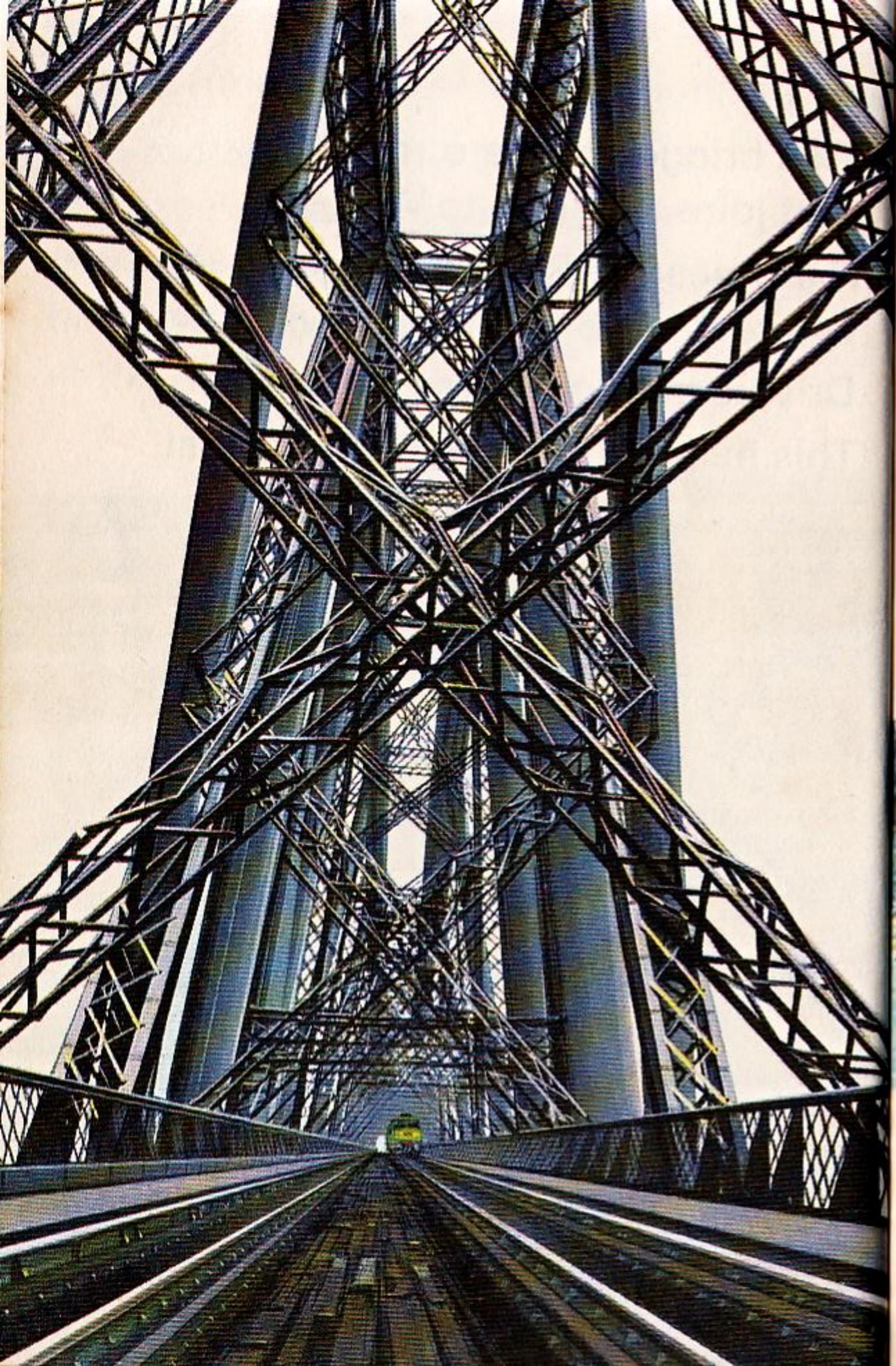


The Golden Gate Suspension Bridge, San Francisco.

This bridge carries a road that joins England to Wales. It crosses the River Severn where it is 1.6 kilometres wide. Drivers pay to use the bridge. This helps to pay the building cost.



The Severn Bridge near Bristol, England.



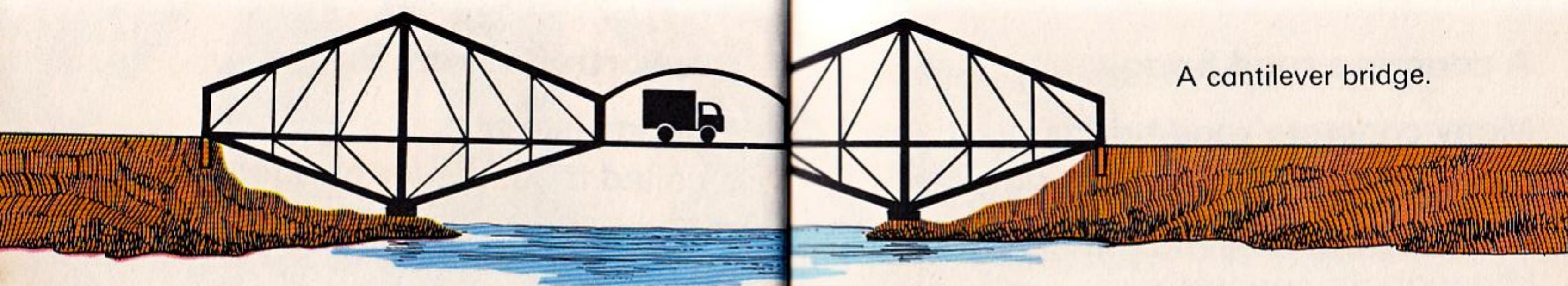
## The Forth Railway Bridge

A bridge like this  
is called a cantilever bridge.

This one is a railway bridge in Scotland.



It took seven years to build.  
Some of the steel tubes you see  
are as wide as the tunnels  
of the London Underground Railway.

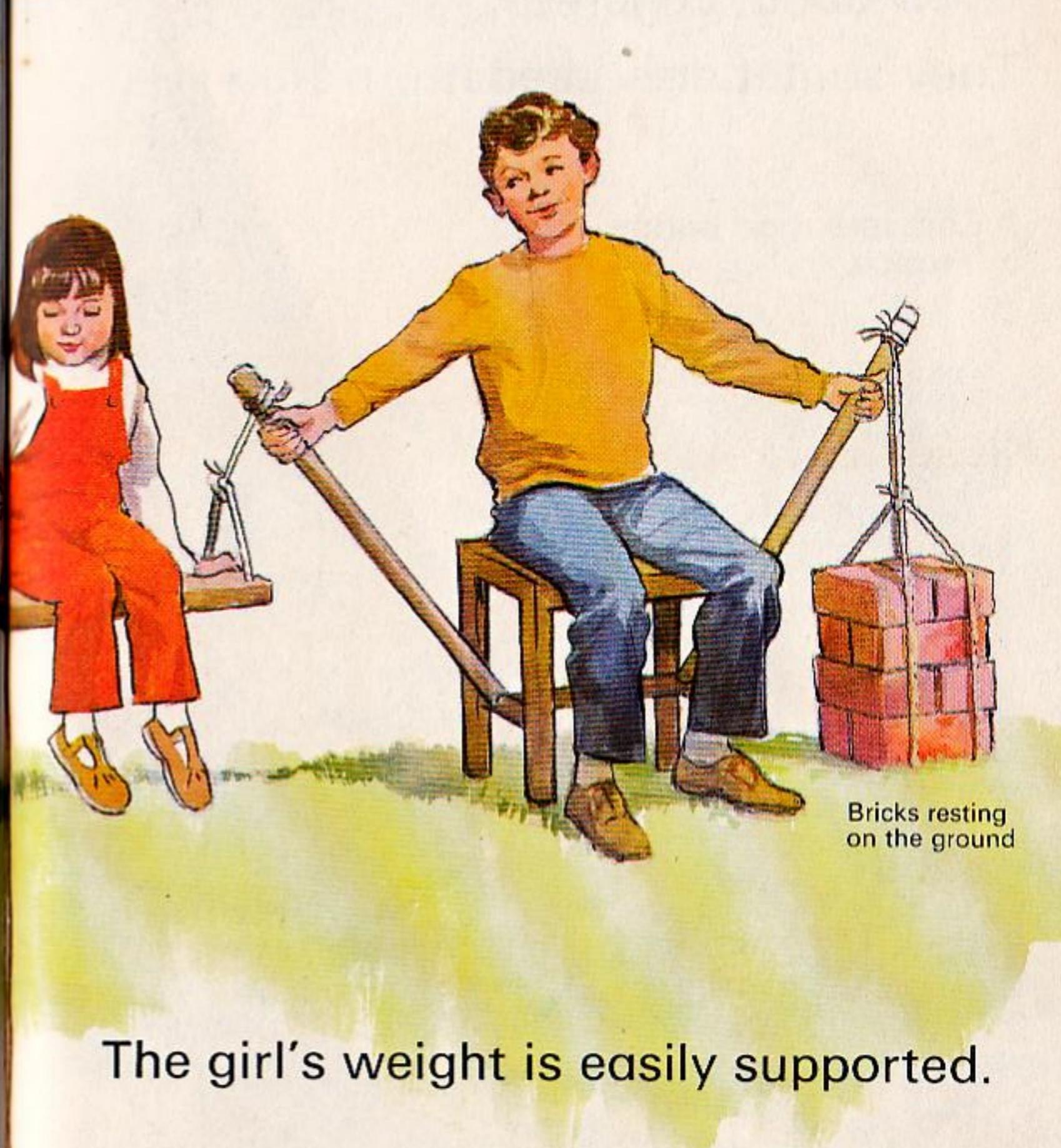


A cantilever bridge.



Bricks resting  
on the ground

The lower picture shows how the load  
is spread over a cantilever bridge.



Bricks resting  
on the ground

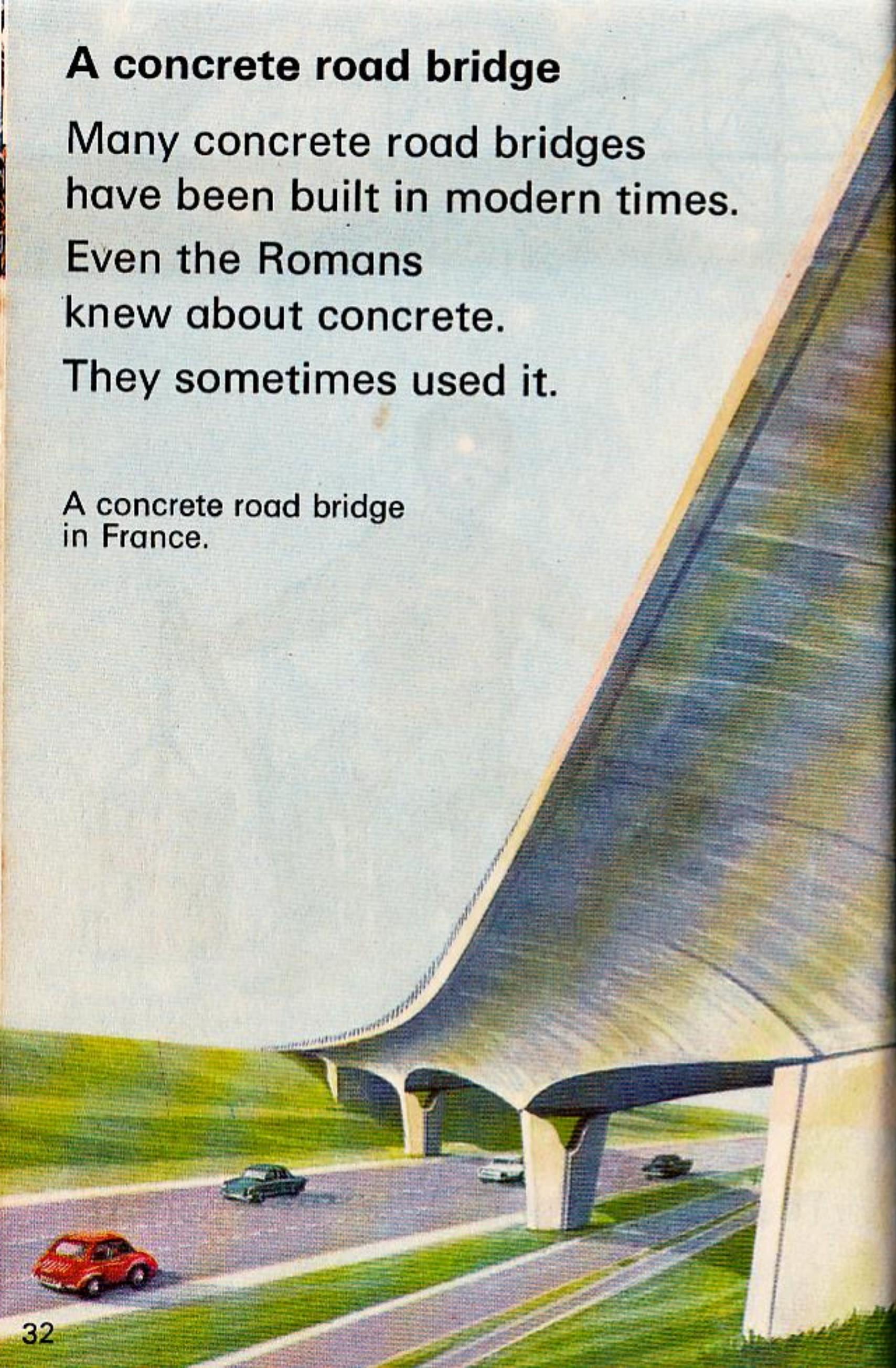
The girl's weight is easily supported.

## A concrete road bridge

Many concrete road bridges have been built in modern times.

Even the Romans knew about concrete. They sometimes used it.

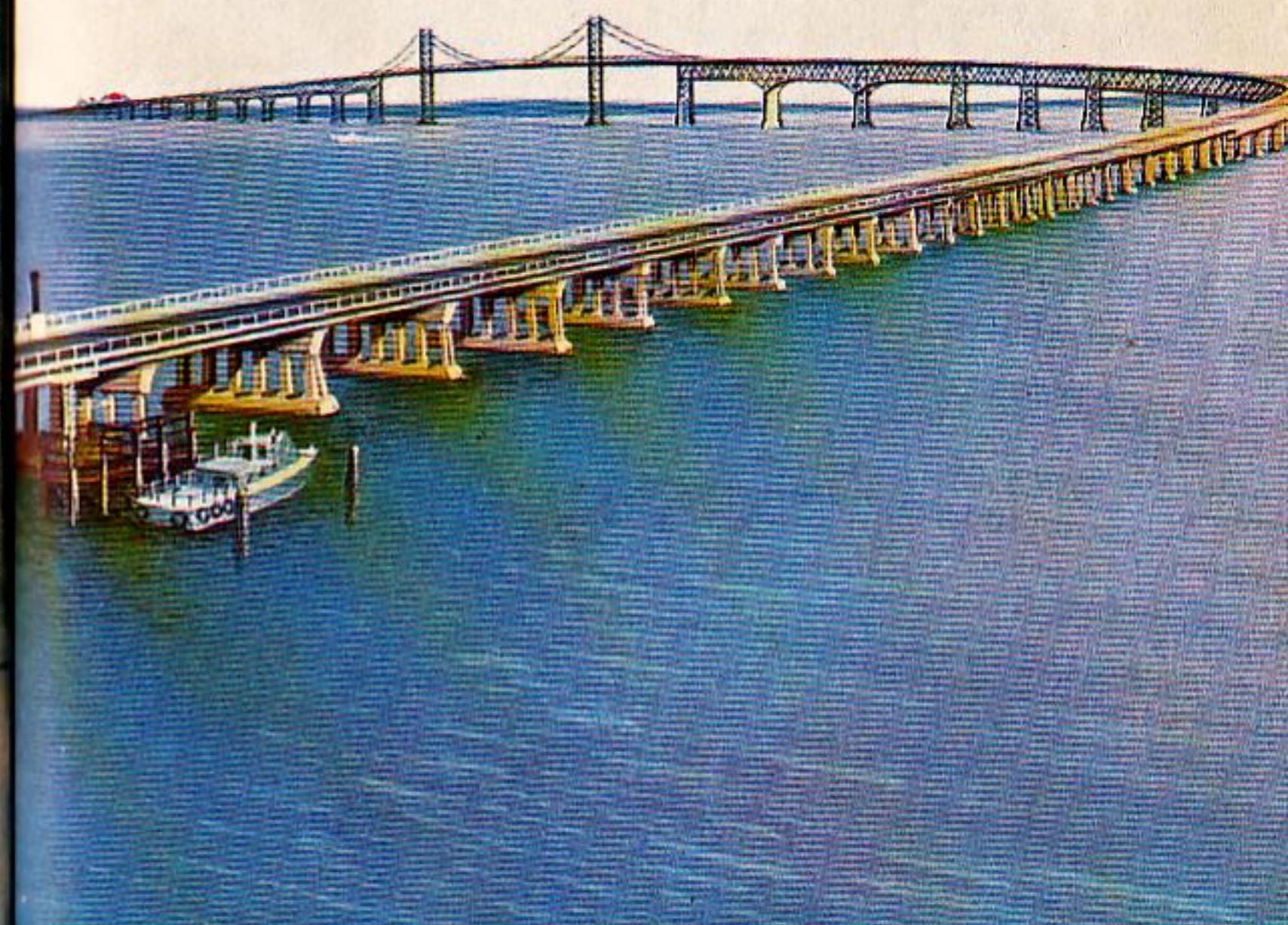
A concrete road bridge in France.



## A very unusual bridge

The Chesapeake Bay Bridge is 28.2 kilometres long.

Part of it is a cantilever bridge, part a suspension bridge and part a trestle bridge.



The Chesapeake Bay Bridge in America.

## A bridge that moves up and down

The roadway of London's Tower Bridge can move up to let ships pass through. Often, small wooden canal bridges lift up to let boats through.



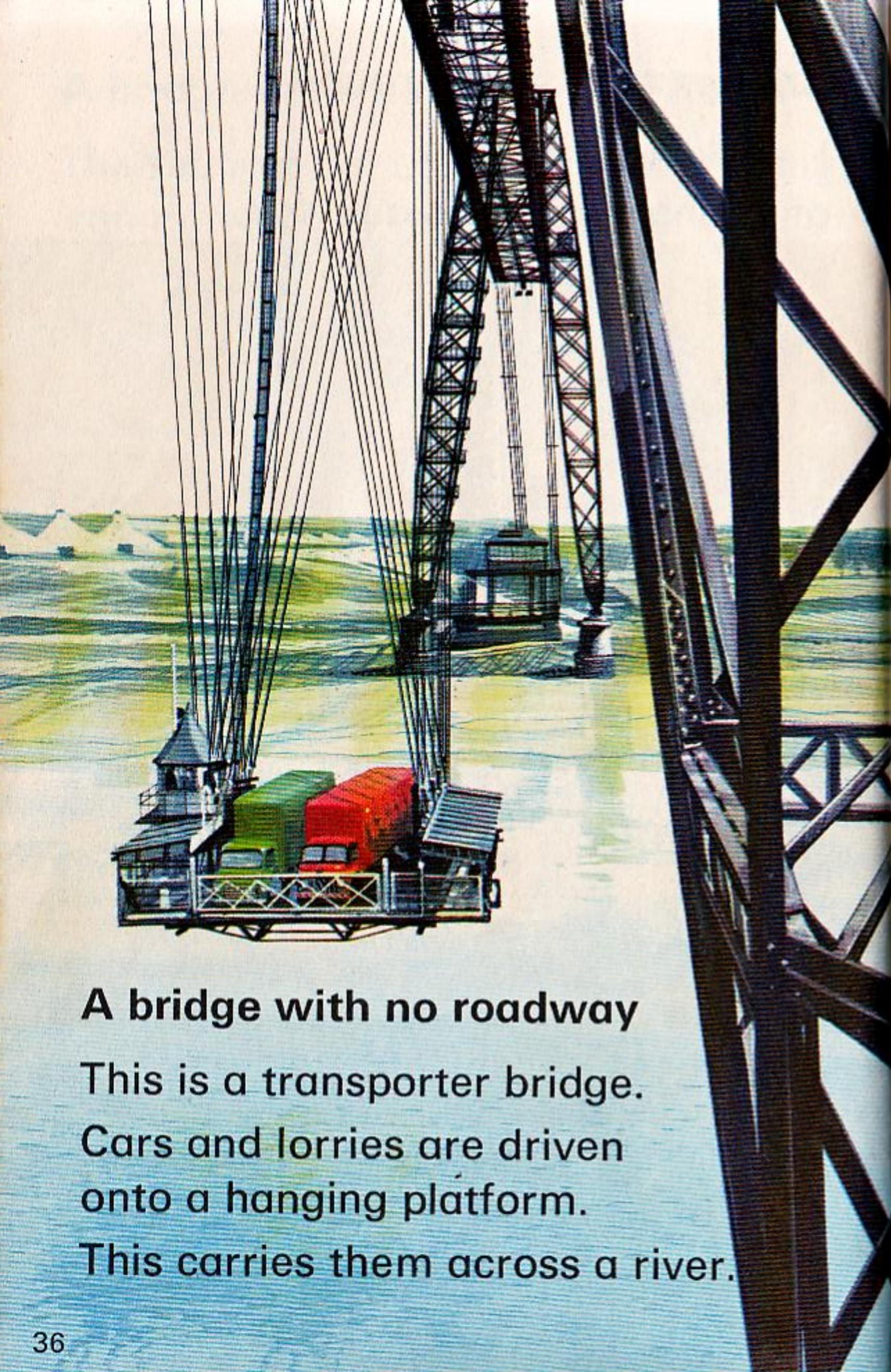
## Bridges that swing round

Here is another way of letting ships pass a bridge.



Both these bridges turn from the middle.

One is part of a canal.  
The other carries a road.



### A bridge with no roadway

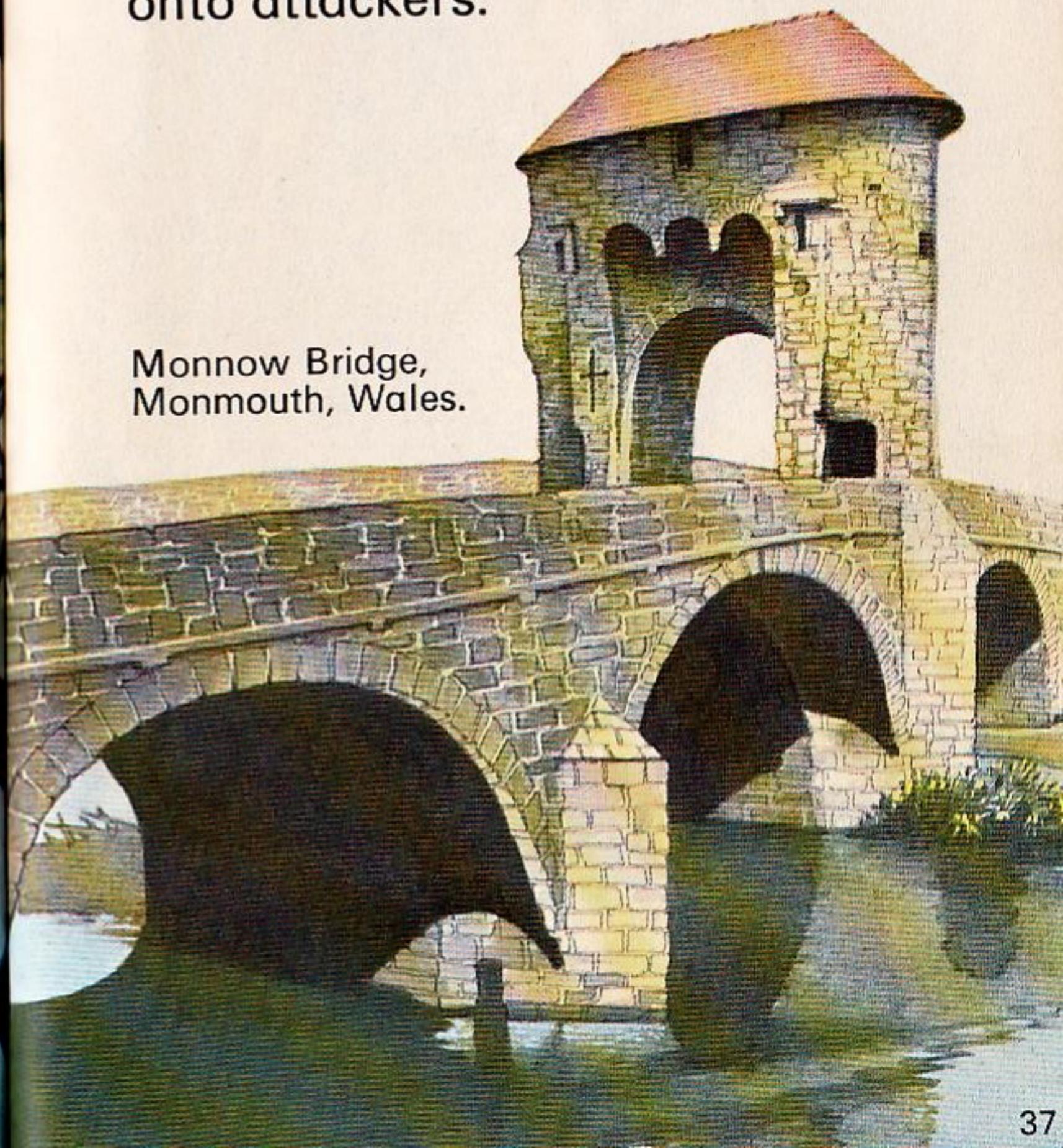
This is a transporter bridge.  
Cars and lorries are driven  
onto a hanging platform.

This carries them across a river.

### An old fortified bridge

Long ago, some bridges were fortified  
to stop an enemy crossing them.  
Molten lead and boiling oil  
were dropped from this tower  
onto attackers.

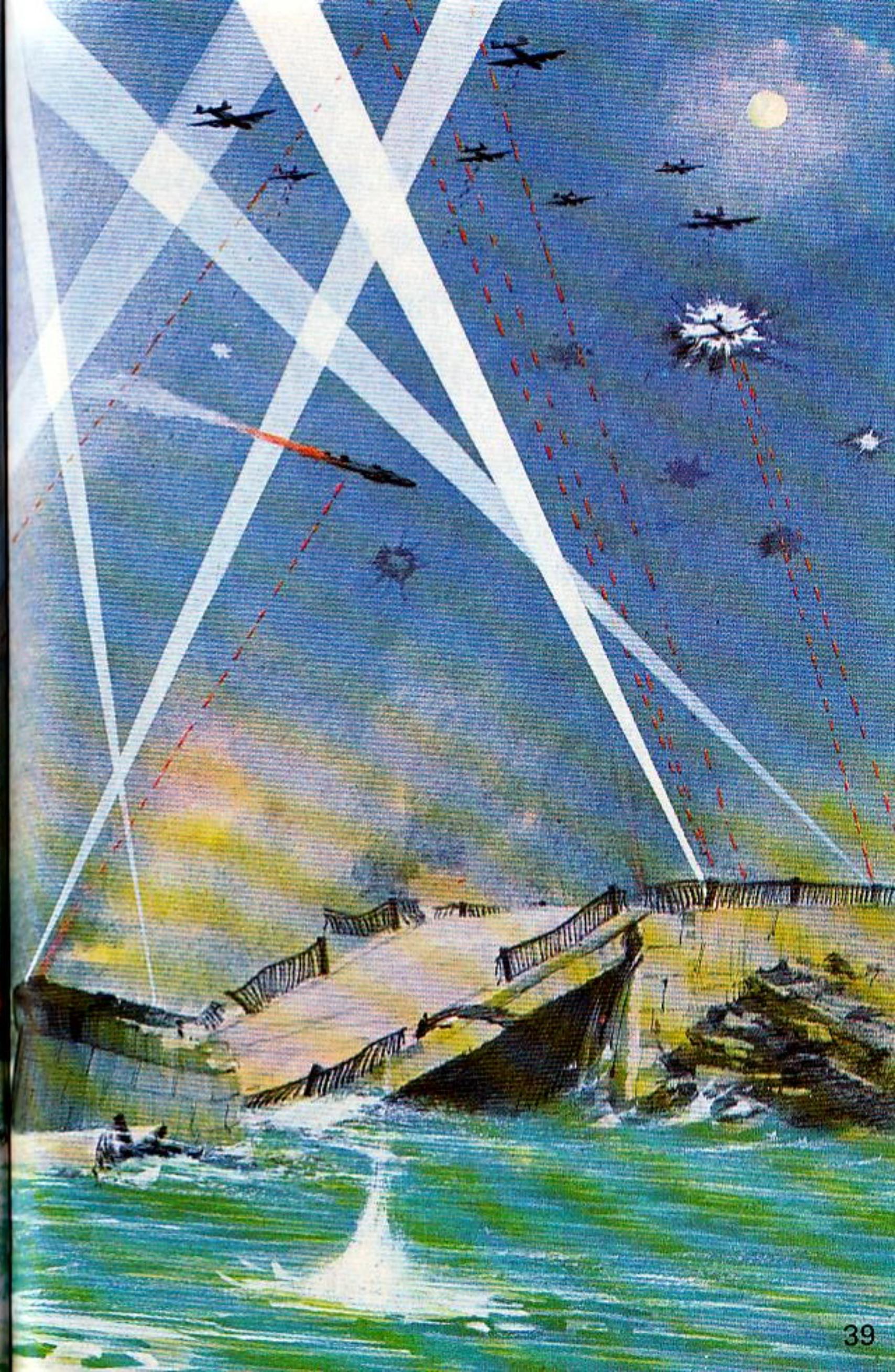
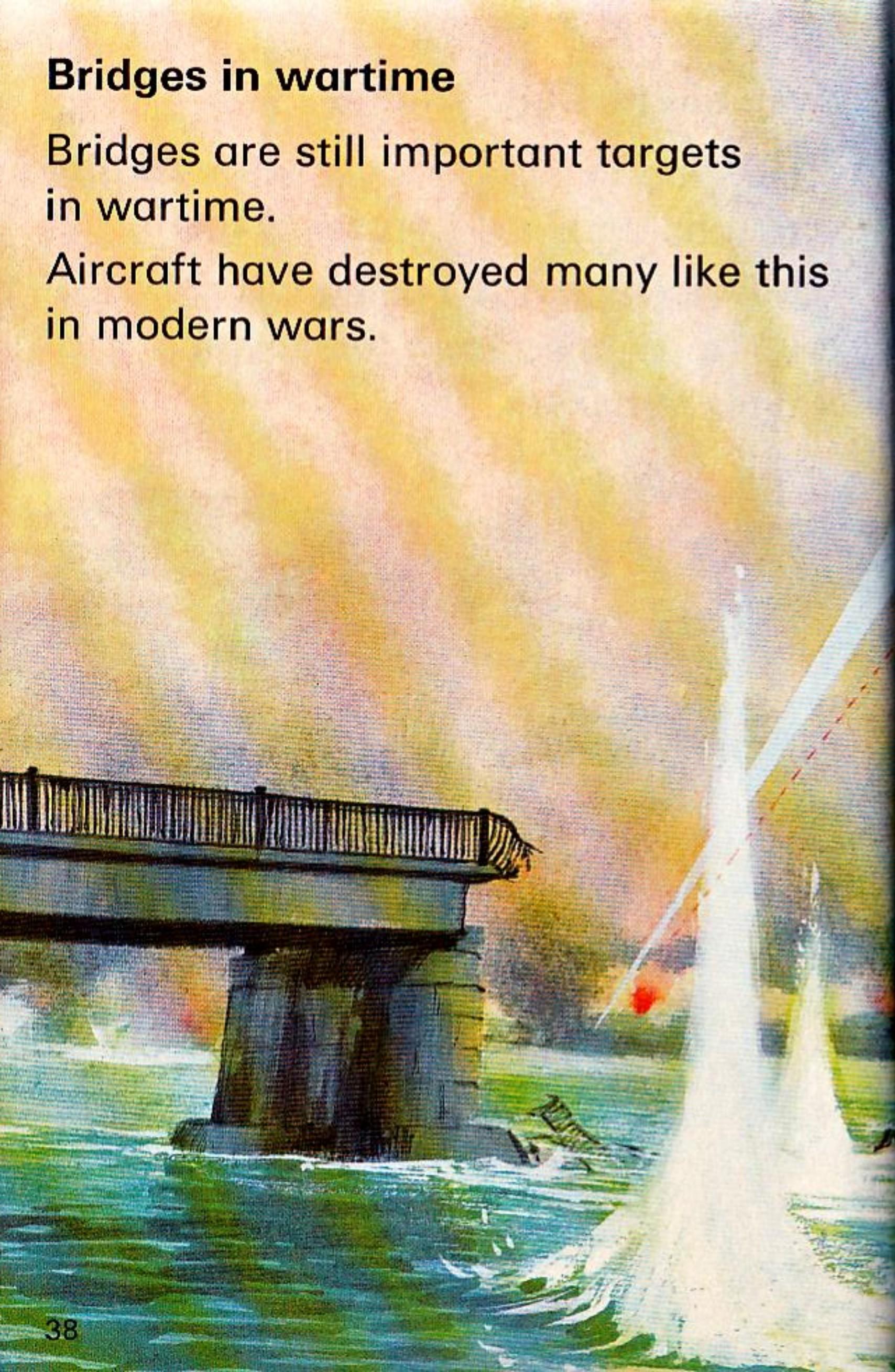
Monnow Bridge,  
Monmouth, Wales.



## Bridges in wartime

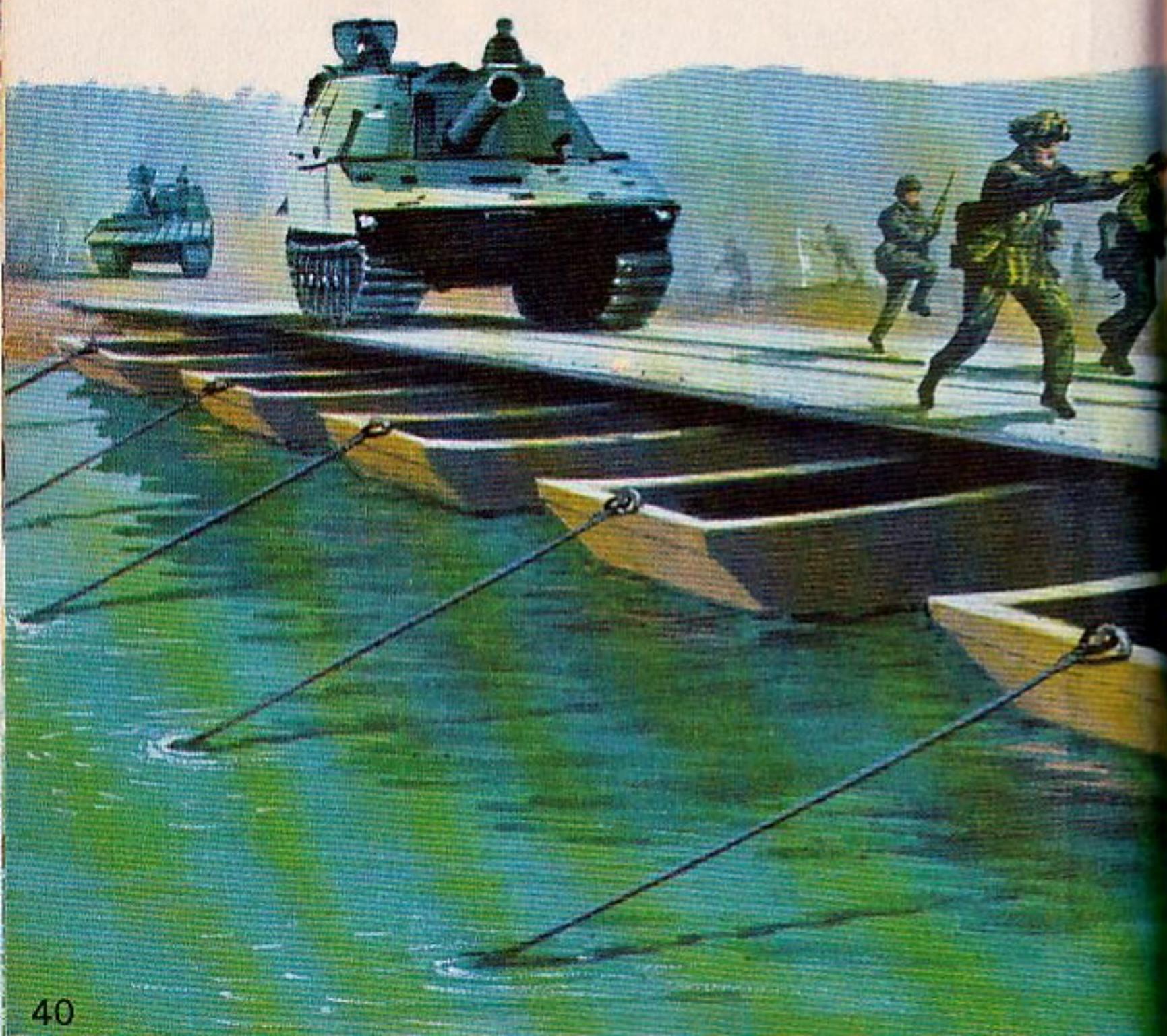
Bridges are still important targets in wartime.

Aircraft have destroyed many like this in modern wars.



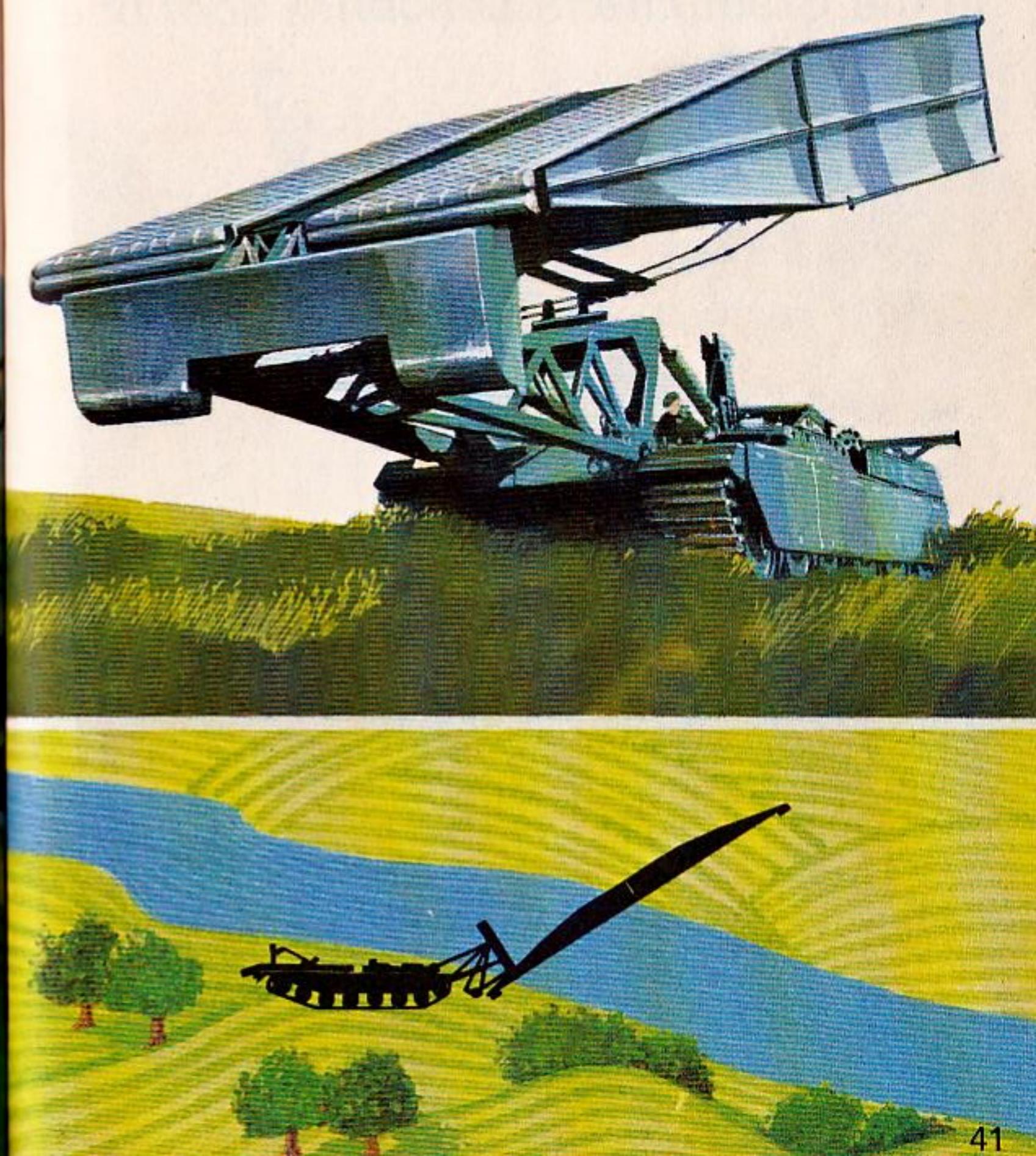
## Pontoon bridges

The Romans used 'pontoon' bridges. Modern armies still use them. Flat-bottomed boats hold up the roadway of this pontoon bridge.



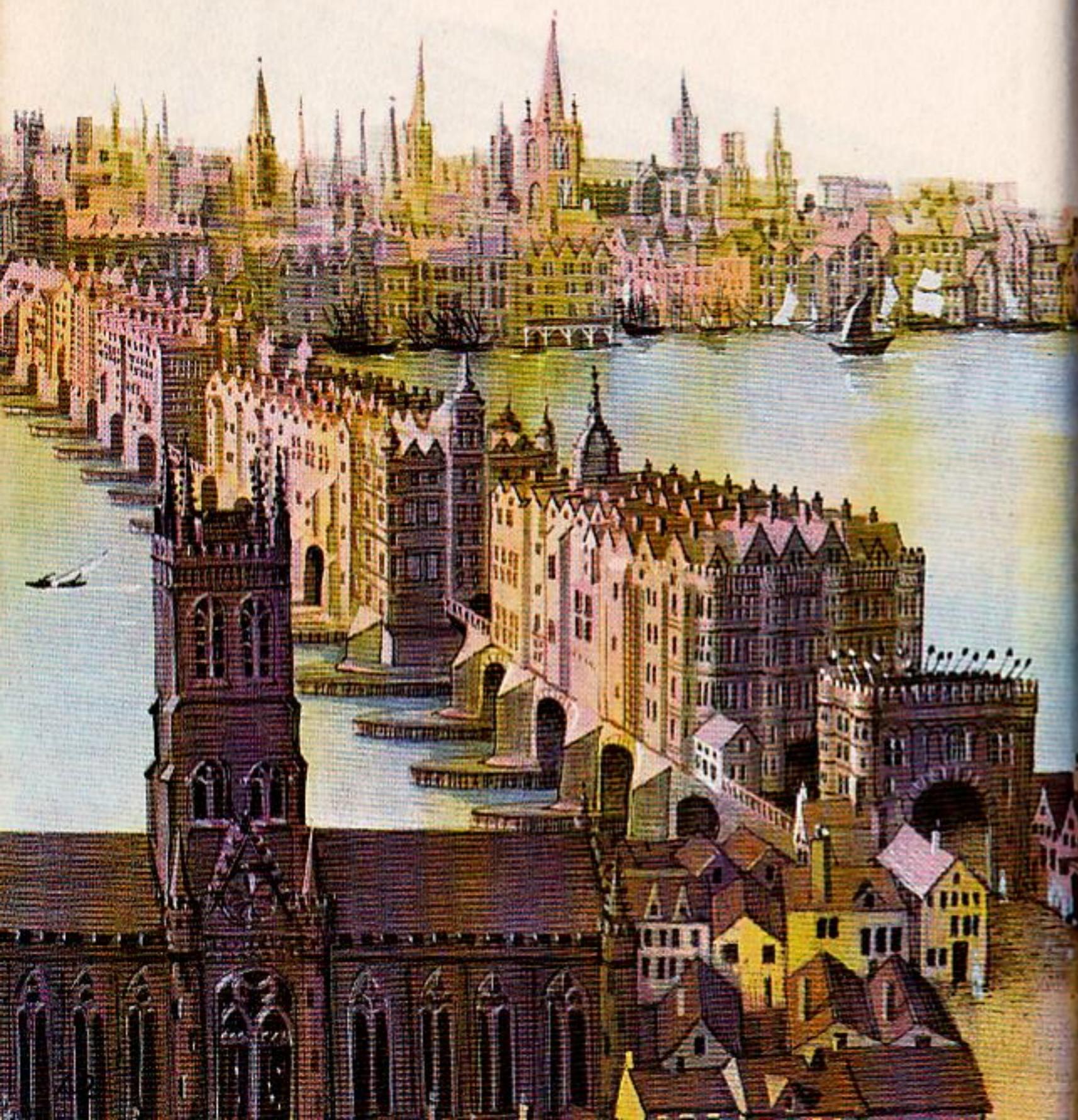
## Mobile bridges

Today, an army can soon bridge a river. Special carriers move bridges like this into position, even under enemy fire.



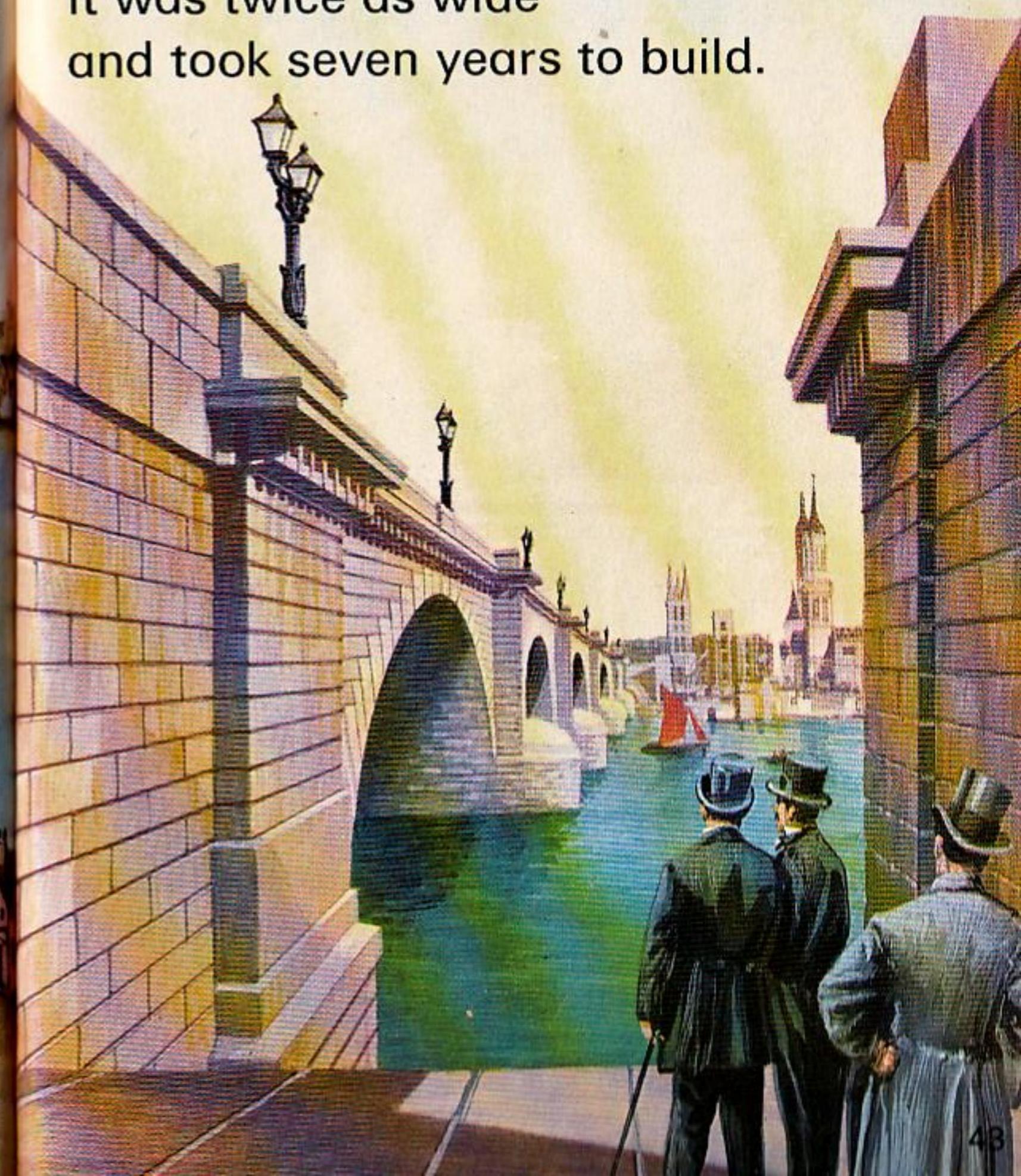
## Old London Bridge

In 1666, London Bridge looked like this.  
On it there were shops, houses,  
a chapel and a drawbridge.  
Many of the buildings were burned down  
in the Great Fire of London.



Old London Bridge was pulled down  
in 1831.

A new bridge had been built by then.  
It was twice as wide  
and took seven years to build.

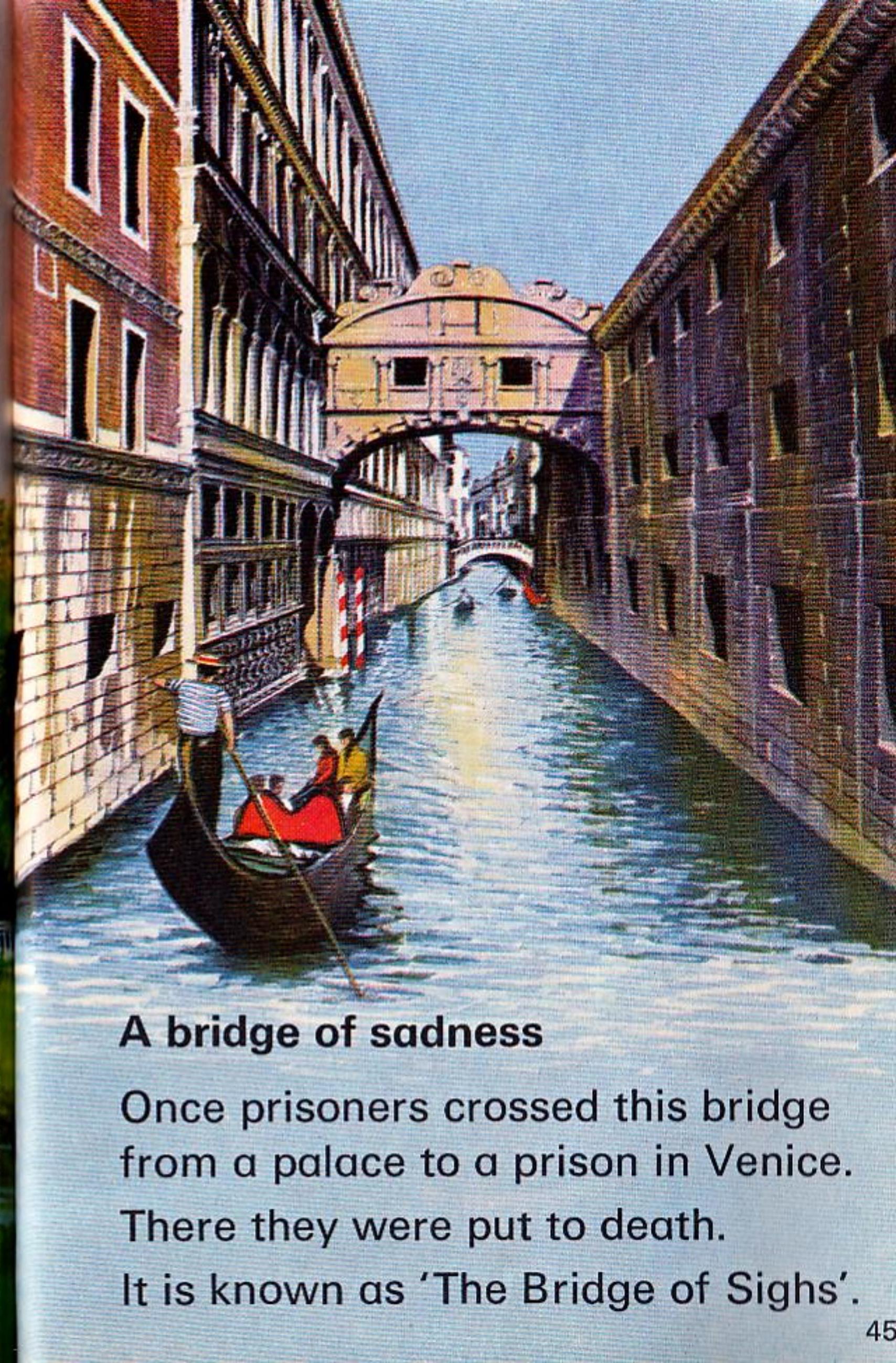


## A bridge to give pleasure

Bridges like this were sometimes made to be looked at, rather than to be used.

They were built by rich people in the parks round their homes.

They were part of a view seen from a big house.



## A bridge of sadness

Once prisoners crossed this bridge from a palace to a prison in Venice.

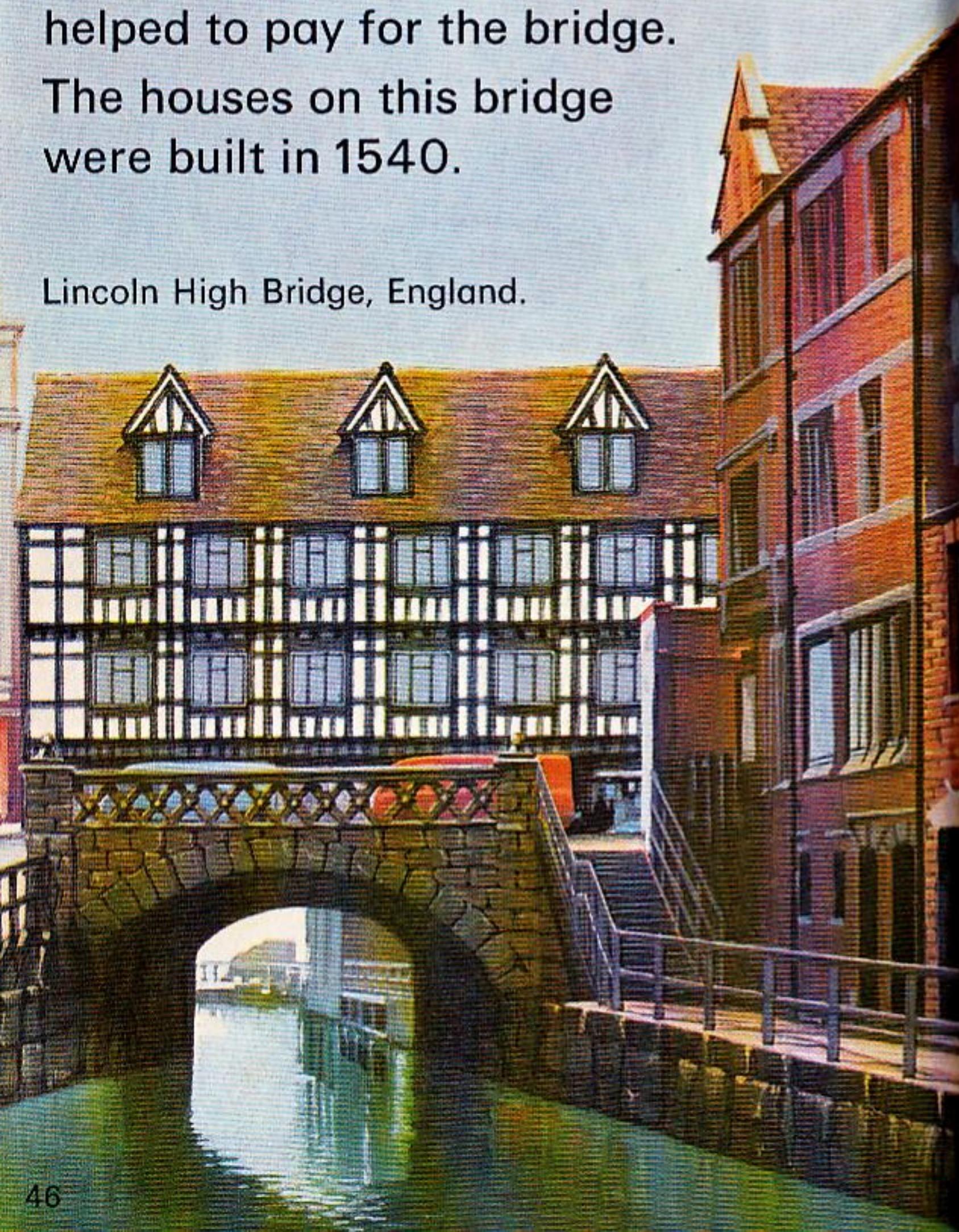
There they were put to death.

It is known as 'The Bridge of Sighs'.

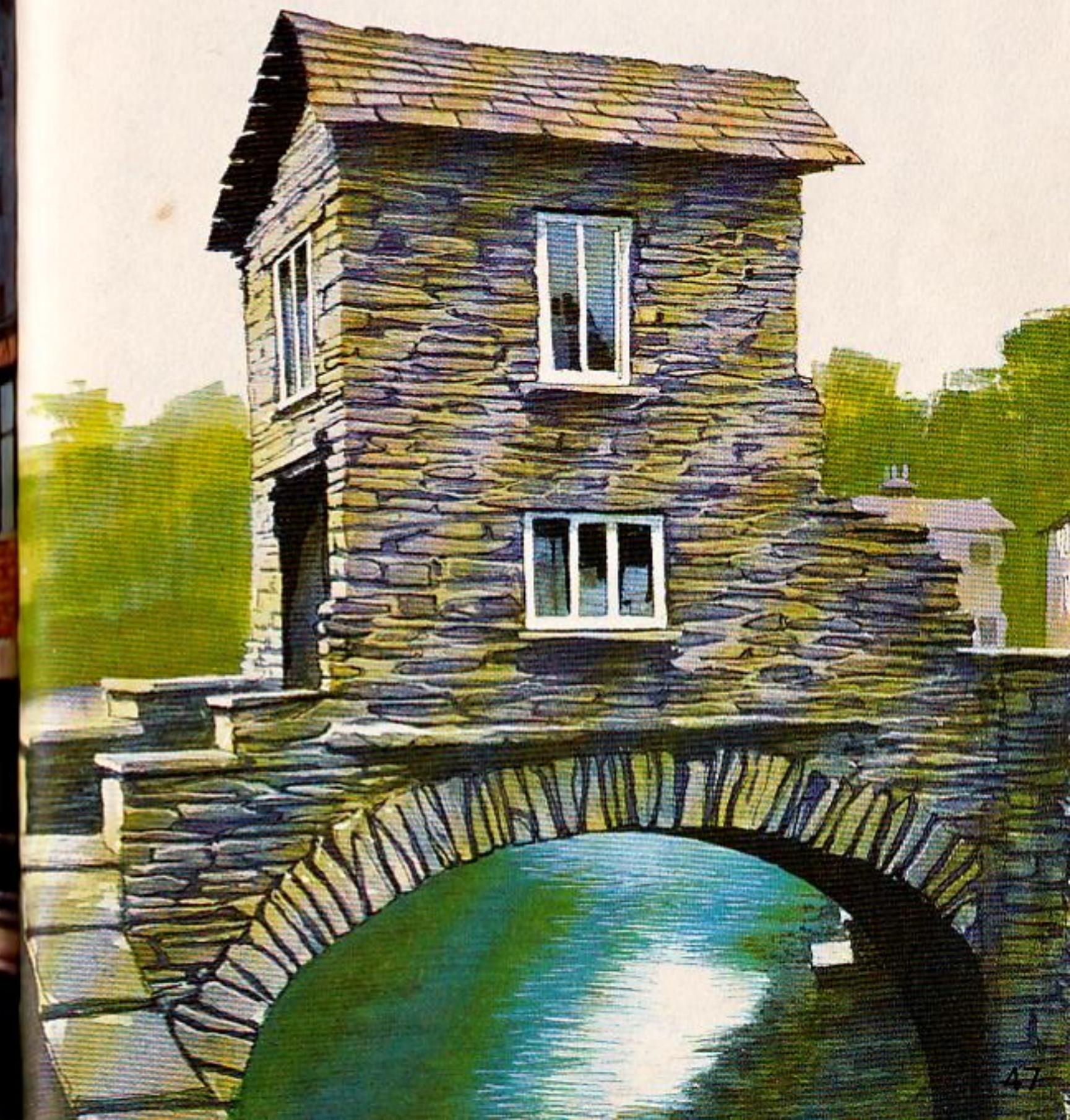
## Bridges with houses

Houses were built on some old bridges.  
The rent from the houses  
helped to pay for the bridge.  
The houses on this bridge  
were built in 1540.

Lincoln High Bridge, England.



At Ambleside, in England's Lake District,  
this charming little house  
stands alone on its small bridge.  
It was built about 200 years ago.

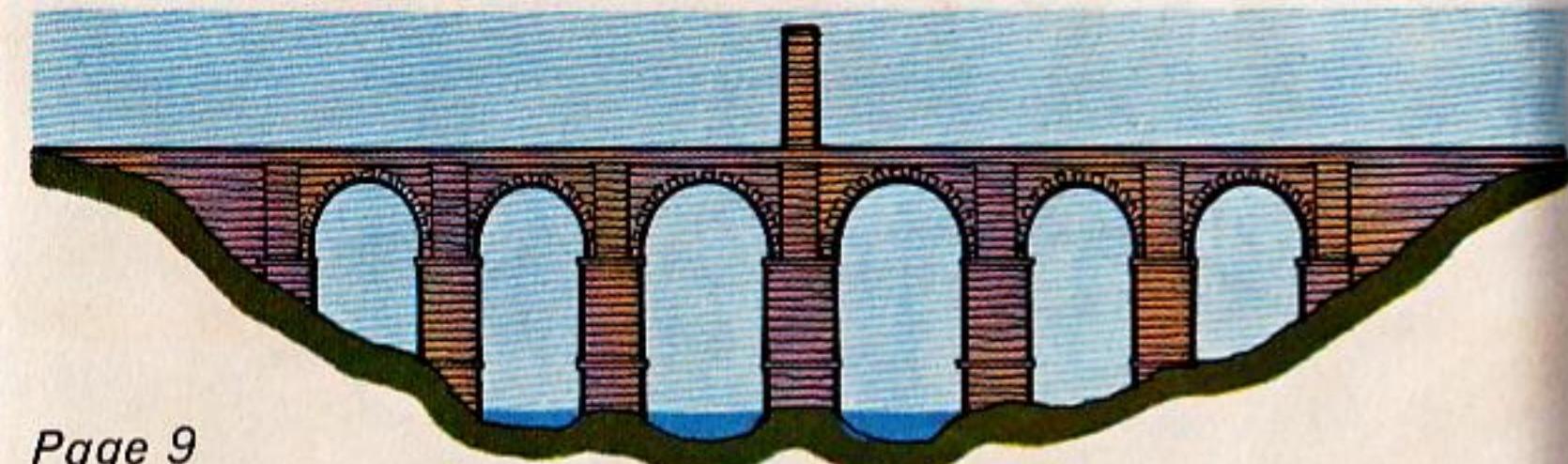


## A great bridge disaster

In a gale, on a Sunday in 1879,  
part of this bridge fell into the water.  
A railway train fell with it  
and 80 people were killed.

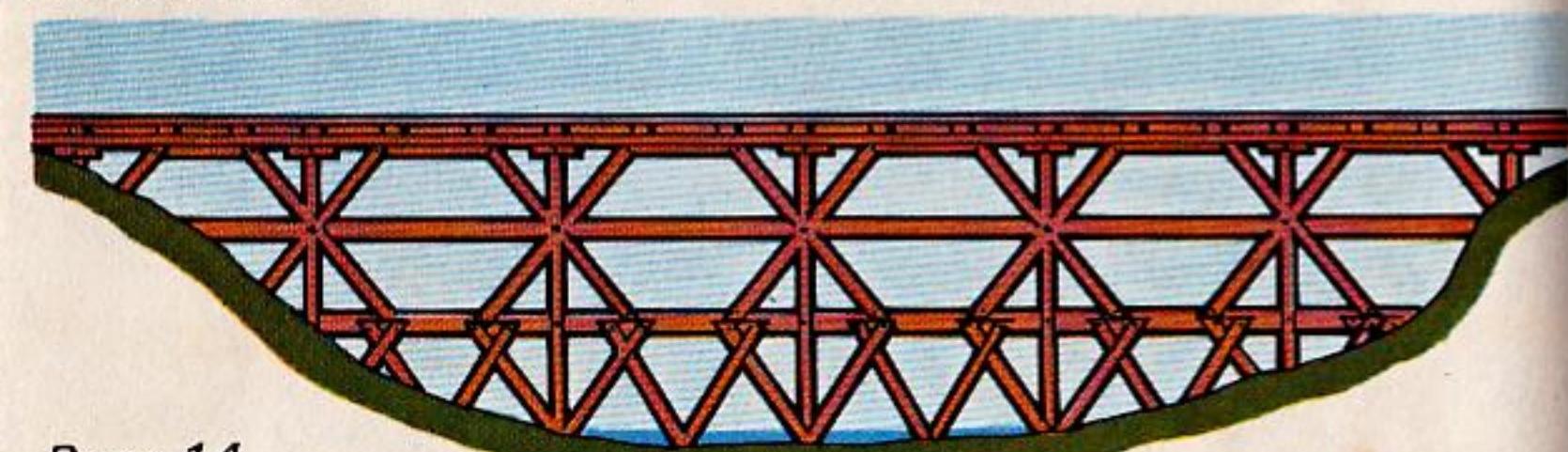
The Tay Bridge, Scotland,  
December 1879.



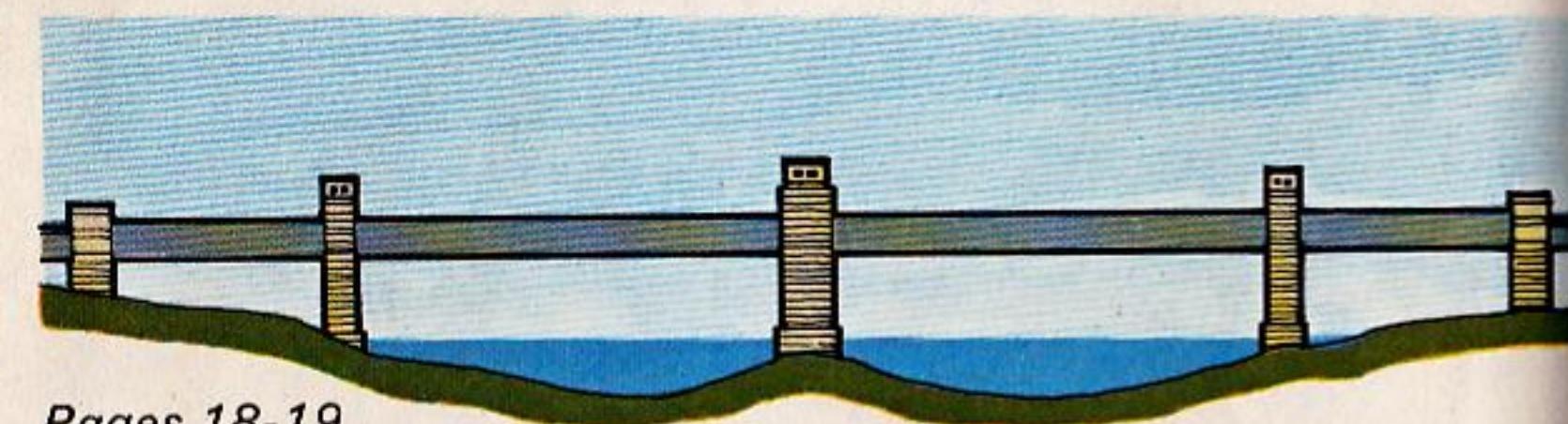


**Page 9**  
**A stone arch bridge**

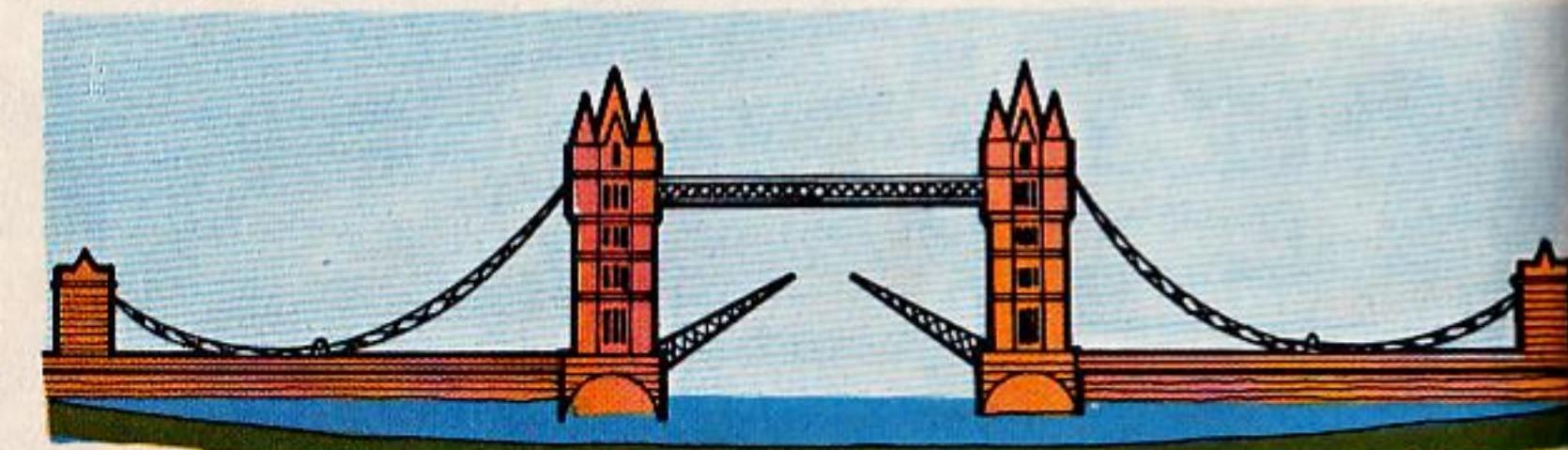
A Roman bridge across the Tagus, Alcantara, Spain



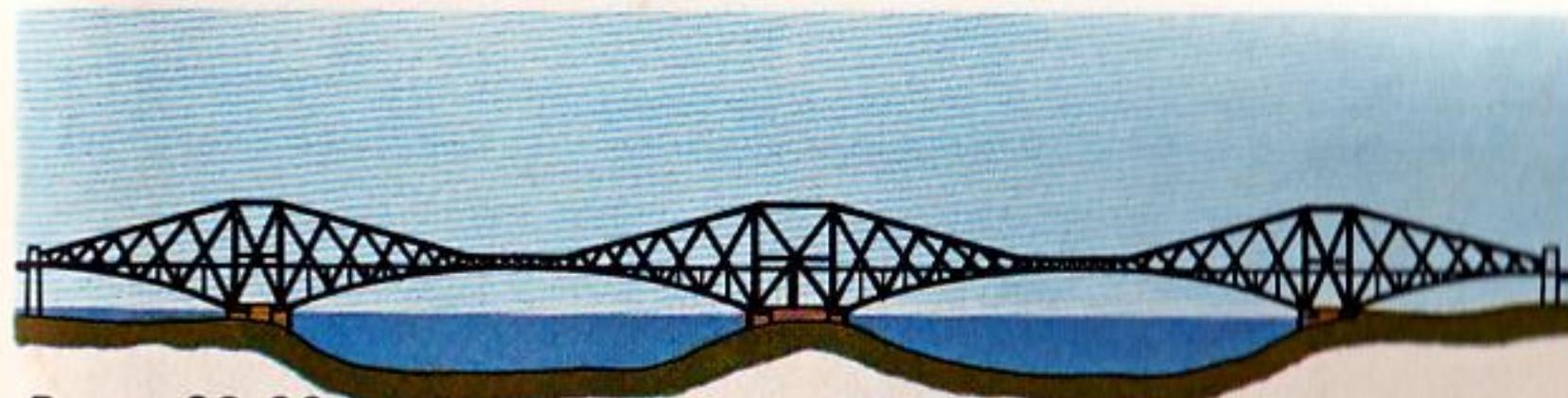
**Page 14**  
**A timber trestle bridge**



**Pages 18-19**  
**A beam bridge** Britannia Bridge over the Menai Strait, Wales



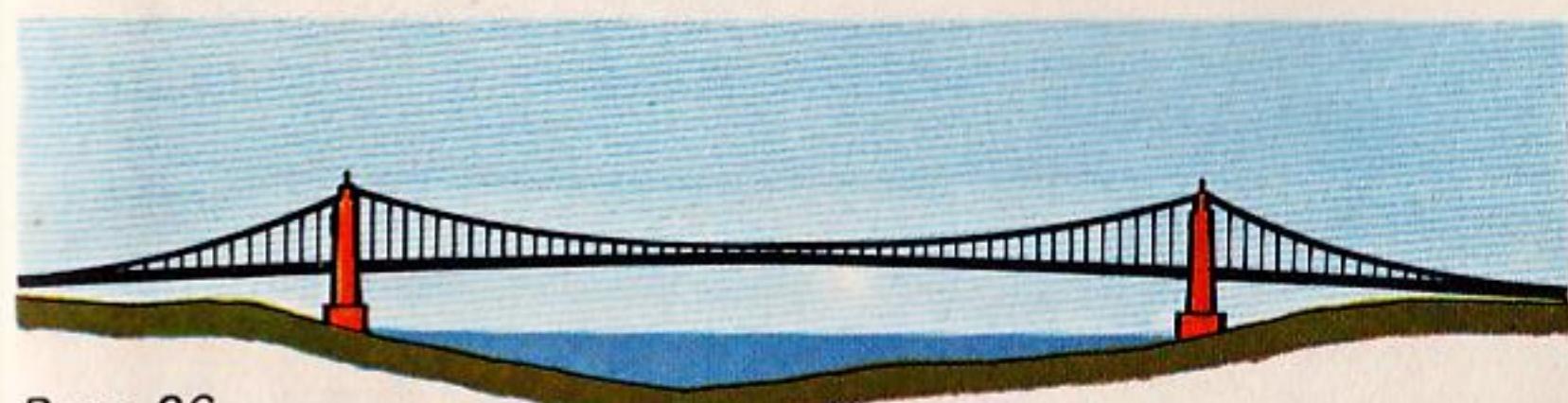
**Page 34**  
**A movement (or bascule) bridge** Tower Bridge, London



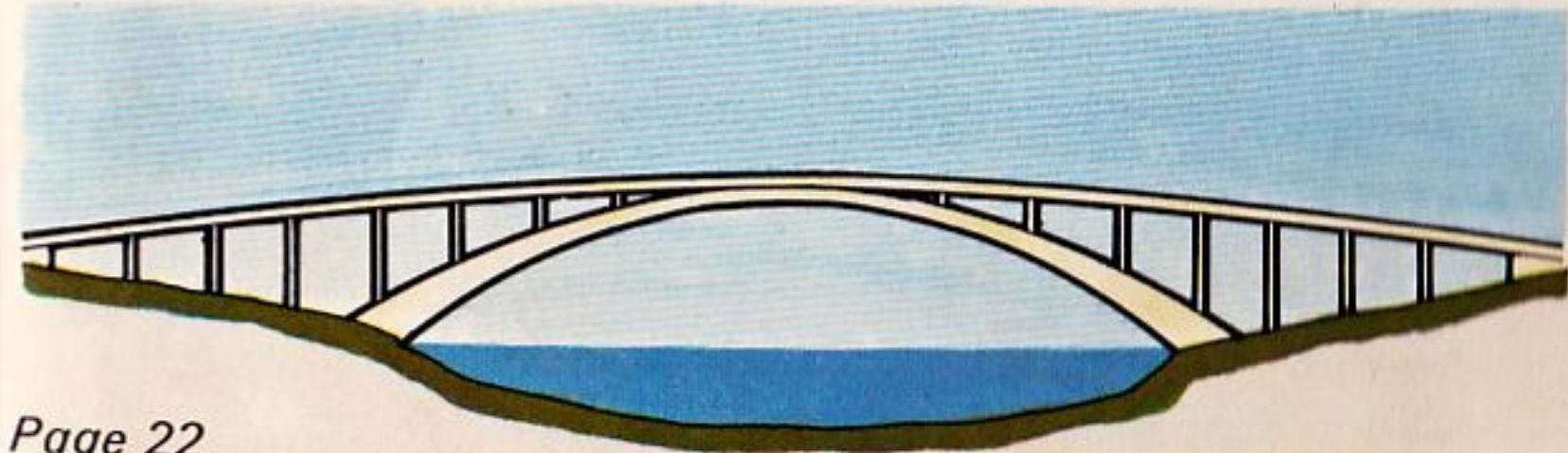
**Pages 28-29**  
**A cantilever bridge** Forth Railway Bridge, Scotland



**Pages 20-21**  
**A steel arch bridge** Sydney Harbour Bridge, Australia



**Page 26**  
**A suspension bridge** Golden Gate Bridge, San Francisco



**Page 22**  
**A concrete arch bridge** Gladesville Bridge, Sydney, Australia

# Index

	page		page
Africa	14	Concrete arch bridge	22, 51
Alcantara	9, 50	Concrete road bridge	32
Ambleside	47	'Cutwaters'	11
America	14, 26, 33, 51	Destruction of bridges (wartime)	38
Aqueduct	10	England	17, 24, 27, 35 46, 47
Arches	10, 13, 22, 23	First arches	8
Armies	40, 41	First bridges	4, 5
Australia	20, 21, 22, 51	Forth Railway Bridge front endpaper, 28, 29, 51	
Barton swing bridges	35	Fortified bridge	37
Bascule bridge	34, 50	France	10, 32
Beam bridges	4, 18, 19, 50	Gales	24, 48, 49
Boats	34, 40	Gladesville Bridge	front endpaper, 22, 51
Braces	15	Golden Gate Bridge	front endpaper, 26, 51
Bridge movement	24	Great Fire of London	42
'Bridge of Sighs'	45	Horses	11, 12
Bristol	24	Houses	42, 46, 47
Britannia Bridge	front endpaper, 18, 19, 50	Iron bridge, first	16, 17
Brunel, Isambard Kingdom	24	Ironbridge	17
Cables	24	Iron tubes	18, 19
Canal bridges	34, 35	Lancashire	35
Cantilever bridge	28, 29, 30, 31, 33, 51		
Chesapeake Bay Bridge	33		
Clapper bridge	7		
Clifton Suspension Bridge	24		

	page		page
Landwasser Viaduct	13	Shropshire (Salop)	17
Length, bridges	front endpaper	Spain	9, 50
Lincoln High Bridge	46	Steel arch bridge	20, 21, 51
London	29, 34, 42, 43, 50	Steel bridges	20, 21, 24, 26, 27, 28, 29, 51
London Bridge	42, 43	Steel reinforcement	22
Menai Strait	19, 50	Steel tubes	29
Middle Ages	11	Stepping stones	6
Mobile bridges	41	Stone bridge	7
Modern bridges	22, 26, 27, 32	Suspension bridges	5, 24, 26, 27, 33, 51
Monmouth	37	Swing bridges	35
Monnow Bridge	37	Switzerland	13
Movement bridge	34, 50	Sydney	front endpaper, 20, 21, 22, 51
Nîmes	10	Sydney Harbour Bridge	front endpaper, 20, 21, 51
Packhorse bridge	12	Tall bridges	10, 13
Pont-du-Gard	front endpaper, 10	Tay Bridge disaster	48, 49
Pontoon bridges	40	Toll bridge	27
Railways	13, 14, 18, 20, 29, 48	Tower Bridge	front endpaper, 34, 50
'Refuges'	11	Transporter bridge	36
River Severn	27	Trestle bridge	14, 33, 50
Roman bridges	9, 10	Underground railway	29
Romans	9, 10, 32, 40	Venice	45
San Francisco	26, 51	Viaduct	13
Scotland	29, 48, 51	Wales	19, 27, 37, 50
Severn Bridge	front endpaper, 27	Wooden bridges	14
Ships	26, 34, 35		